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The Evolution of Automatics

About sixty-three years ago—during the Civil War—the first machine tools with automatic features appeared; and during the great industrial revival after the war numbers of manufacturers and designers devoted more attention to machines that partly eliminated hand operation. But it was not until the seventies that machines completely automatic in their action were produced, those machines being the forerunners of the present-day single-spindle automatic screw machines. Automatic gear-cutting machines were first made in 1877.

In the nineties a successful multiple-spindle automatic made its first appearance, and since then the development of automatic machines for metal working has been very rapid. Instead of being confined to machines of the automatic screw machine type, devoted principally to turning, drilling and threading operations, machines are now made to perform automatically almost every type of machining operation.

When volume output warrants its installation an automatic machine is a wonderful cost reducer—because of the rapidity of the machining process, the low labor cost per piece, and the small floor space required. Forward-looking executives study all their cost factors, and when their output of identical, or similar, pieces is large, they often find that some type of automatic will reduce production costs.

A few examples will be interesting.

A flywheel, previously produced at a rate of 200 in 9 hours by 17 machines and 7 operators, is now made on 2 automatic machines; 2 operators finishing 270 flywheels in 9 hours. The floor space required is one-quarter of that formerly needed; the wages of 5 men and 75 per cent of the floor space being saved.

In the production of bevel gear blanks at the rate of 1200 per day, the substitution of automatic machines for the equipment formerly used saved 18 cents per piece, or an average daily saving of over $200.

In the production of brake spiders in an automobile plant, 13 machines and 13 operators have been replaced by 3 automatic machines requiring 3 operators, saving the wages of 10 men.

These figures seem wonderful; but they represent current practice, and if your volume output warrants, automatics will interest you.

MACHINERY

The Wright Whirlwind Engine

The Engine that Made Lindbergh's, Chamberlin's, and Byrd's Record-making Flights Possible—Constructional Features and Machining Operations

By FREEMAN C. DUSTON

TO the man who flies, the modern airplane seems as safe or safer than the automobile. True, we frequently read about flying accidents, but the automobile accidents that occur every hour have ceased to interest us—they have become commonplace. It is only a question of time when the public will no longer question the safety of our passenger air lines.

In 1925 nearly 25,000,000 miles were flown by the United States Army, Navy, Air Mail, and civilian fliers. The 1926 mileage has not yet been compiled, but it is undoubtedly much greater. Already, many of the industrial leaders of our country, realizing that the men who save the most time generally reap the richest reward, are regularly employing airplanes for their personal use.

From the beginning, engine failure has probably been the greatest flying hazard. Through the efforts of Charles L. Lawrance, president of the Wright Aeronautical Corporation, Paterson, N. J., who started the development of small-power air-cooled motors in 1916, we now have an air-cooled engine of 200 horsepower which has proved its reliability under the most severe tests. Through sleet and snow, over the ice fields to the North Pole, over burning sands of equatorial deserts, this remarkable motor has carried through and demonstrated its ability to function under extremes of temperature and weather conditions. Within the last fifteen months three outstanding records have been made by different pilots flying planes made by different manufacturers, but all equipped with Wright "Whirlwind" engines. These planes are shown in Figs. 4, 5, and 6.

It is not surprising that the public at large have been slow to accept a mode of travel so different from any past means of transportation as the airplane. Lindbergh's, Chamberlin's, and Byrd's epoch-making flights have done more than anything else could possibly do to focus public attention on the airplane as a practicable means of transportation, and to convince the world that the modern airplane is safe for commercial purposes when piloted by experienced men. Such achievements as these will bring about the practical application of commercial airplane transportation to an ever-increasing extent. A great new transportation industry is in the process of development and this, in turn, will create other great industries devoted to the building of planes and airplane engines—industries that in the not distant future may rival the greatest industries of today.

In addition to these records, the first, second, and third prizes of the 2500-mile Airplane Tour of 1926 were taken by planes equipped with "Whirlwind" engines. A 100-hour full-throttle non-stop test, with the engine developing 225 horsepower, was recently made by the Navy Department on one of these engines. The engine was also put through a 50-hour overload test on which it developed 295 horsepower.

It is only natural that readers of MACHINERY who make it a point to keep informed on developments in the mechanical field should be interested in the general design and functioning of

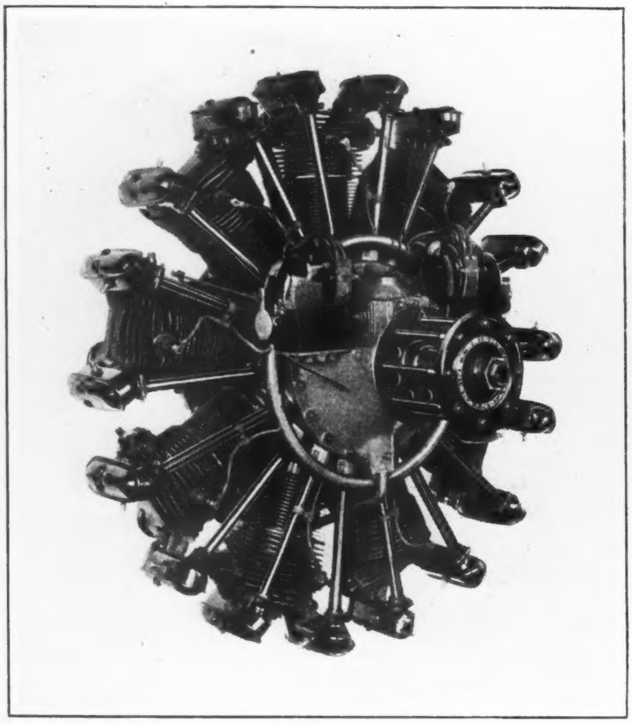


Fig. 1. Front or Propeller Side of the 200-horsepower Wright "Whirlwind" Air-cooled Engine

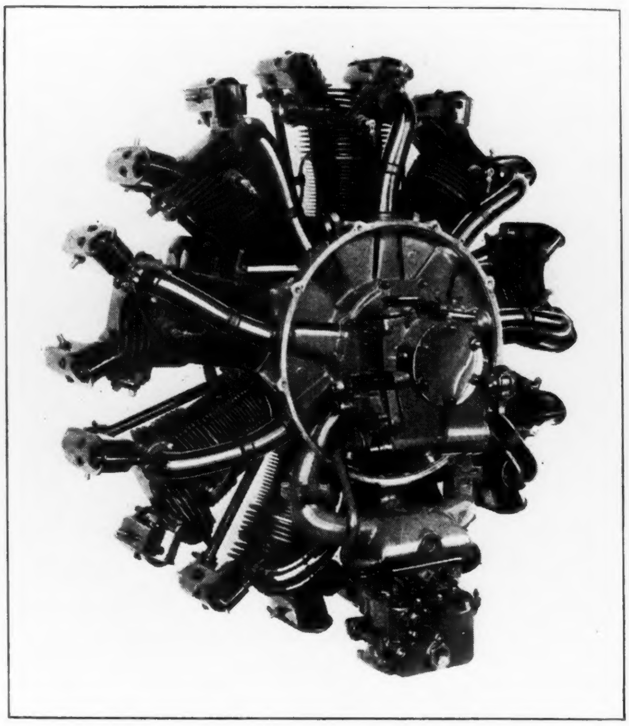


Fig. 2. Rear Side of Engine, Showing the Oil-pump and the Special Three-intake Manifold Carburetor

the Wright "Whirlwind" engine, which is obviously included in the "we" with which Lindbergh modestly refers to his flight from New York to Paris. Those who are familiar with the latest types of automobile engines, but who have had no experience with air-cooled motors of the fixed radial cylinder type, will undoubtedly appreciate a brief explanation of some of the constructional and operating features of this type of motor.

Unique Connecting-rod Arrangement

Referring to Figs. 1 and 2, the nine cylinders of the engine are equally spaced around the crankcase with their axial center lines in the same vertical plane. The single-throw crank runs in bearings mounted in the sides of the crankcase. The piston in the cylinder at the top, which we will call cylinder No. 1, is fastened by the piston-pin to the

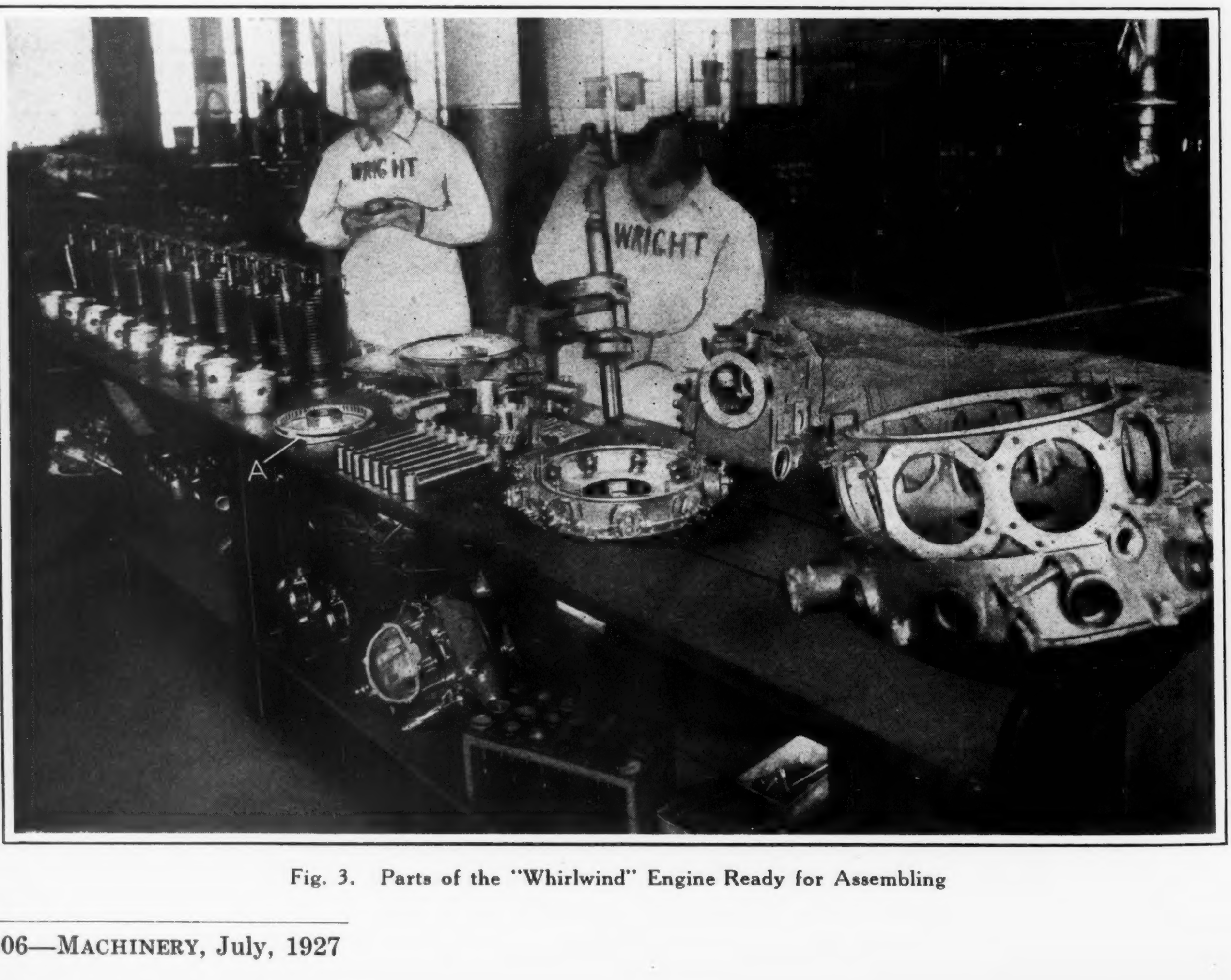


Fig. 3. Parts of the "Whirlwind" Engine Ready for Assembling

small end of the master connecting-rod shown in Fig. 14. The split bearing at the large end of this rod is carefully fitted to the throw bearing of the crankshaft. The eight pistons of the remaining cylinders are connected to the large end of the master rod by small connecting-rods, commonly referred to as articulating rods. Two of these rods are shown connected to the master rod in Fig. 14.

Fig. 4. Columbia-Bellanca Monoplane in which Chamberlin Flew from New York to Eisleben in Germany in 43 Hours. This Plane Also Broke the World's Endurance Record by Remaining in the Air 51 Hours 11 Minutes 20 Seconds

Valve-operating Mechanism

The engine operates on the familiar four-stroke cycle principle. The valve push-rods which operate the exhaust and inlet valves are actuated by a four-lobe cam which is concentric with and bears on a sleeve on the crankshaft. The construction of the cam and the method employed in grinding its contour will be described in a later article. This cam is shown at *A* in Fig. 3.

The cam runs in the opposite direction to the crankshaft and at one-eighth the speed. The drive is through an internal gear formed on the inner circumference of the cam. This meshes with a pinion on a countershaft which carries a spur gear in mesh with a spur gear on the forward end of the crankshaft. The lobes on the periphery of the cam that operate the inlet valves are located on one side, and the lobes that operate the exhaust valves on the other. With this engine, the inlet opens 8 degrees early and closes 60 degrees late. The exhaust opens 60 degrees early and closes 8 degrees late. Assuming that we call the cylinder at the top No. 1 and number the remaining cylinders in a counter-clockwise direction, the firing order would be 1, 3, 5, 7, 9, 2, 4, 6, 8.

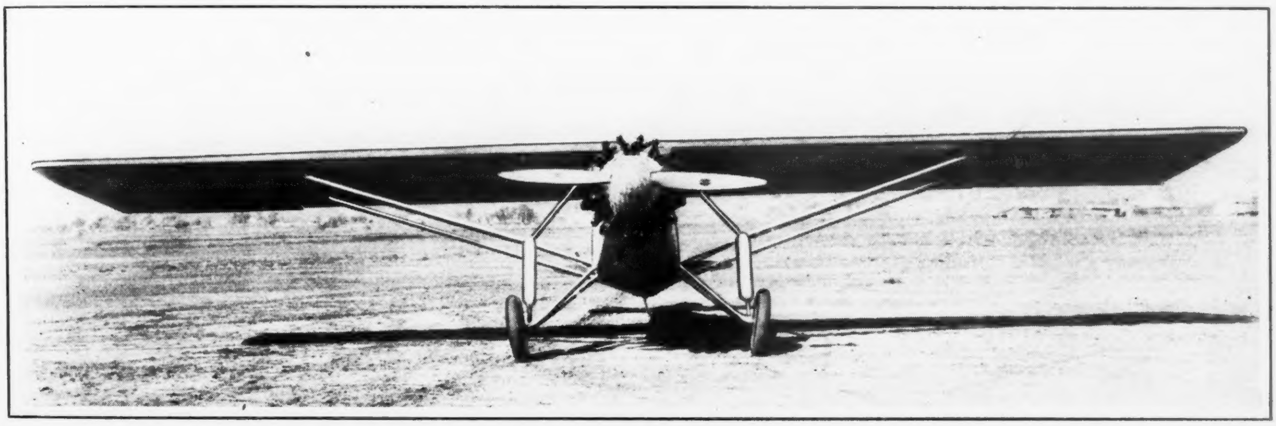


Fig. 5. Lindbergh's Ryan Monoplane which Flew 3600 Miles from New York to Paris in 33 1/2 Hours

Double Ignition System

The ignition is furnished by two "Scintilla" magnetos mounted on the front crankcase section, as shown in Fig. 1. Each magneto fires one plug in each cylinder, the two plugs being located on opposite sides of the cylinder head. A special Stromberg carburetor may be seen attached to the intake manifold of the crankcase at the lowest point in Fig. 2. There are actually three intake manifolds, each feeding three cylinders through tubes, which can readily be identified in the illustration.

Fig. 6. Fokker Airplane, Equipped with Three Wright "Whirlwind" Engines, in which Lieutenant-Commander Richard E. Byrd Made His Famous Flight

The Lubricating System

The lubricating system is of the full-pressure type, except for the cylinder walls and wrist-pins, which are lubricated by oil thrown from the crankpin by centrifugal force, thus supplying the same amount of oil to all cylinders, regardless of location. Oil is carried in an external tank.

Machining the Cylinder Barrels

In Fig. 7 is shown a double-spindle turret lathe engaged in turning the forged-steel cylinder

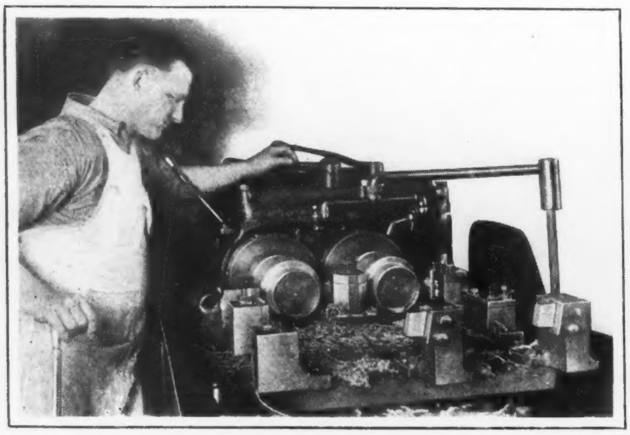


Fig. 7. Turning Cylinder Barrels on Double-spindle Turret Lathe

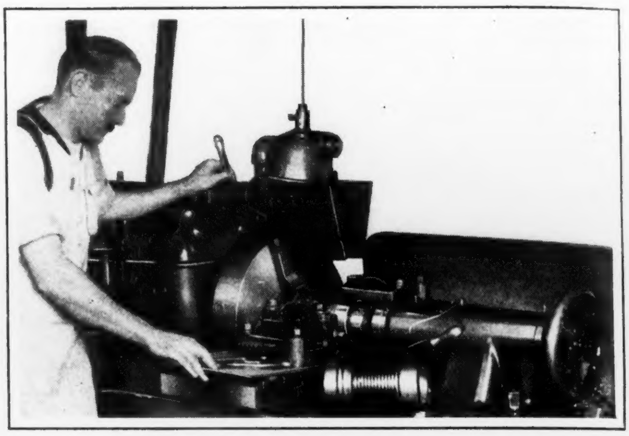


Fig. 8. Forming the Cooling Fins of Cylinder Barrels in Specially Equipped Lathe

barrels ready for forming the fins on the "Duomatic" lathe shown in Fig. 8. The cylinder barrels are in semi-finished condition, the bore being finish-bored and the outside semi-finished. The cylinder barrel fins are turned on an expansion arbor. Two tool-blocks with multiple tools—one in front and one in the rear—work simultaneously in turning the fins. The fins are approximately 13/16 inch deep, and taper from 0.030 to 0.060 inch on the thickness. Thickness, depth, and finish are carefully checked, as inspection is very strict on the quality of work produced.

In Fig. 11 is shown a workman engaged in grinding the bore of the cylinder barrel. The cylinder is first bolted to a chuck plate shown at the base of the cylinder resting on the stand at the side of the machine. A centering fixture is secured to the cylinder head, which is assembled to the barrel before the bore is ground. The chuck plate and the centering fixture serve to line up the bore accurately and hold the cylinder securely during the grinding operation, which removes 0.028 inch of metal. The time required for this operation is approximately 1/2 hour per cylinder.

Fig. 9. Rolling Operation on Inserted Valve Seat

In Fig. 9 is shown one of the aluminum alloy cylinder heads and the tool employed in rolling the flange of an aluminum bronze valve seat into the annular undercut, which operation, in addition to shrinking, serves to securely hold the valve seat in place. The shrinking operation consists of heating the cylinder head slowly until it has reached a temperature of 750 degrees. This requires about one hour. The seat is then put in place with a special holding tool and the head allowed to cool down slowly, after which the rolling operation is performed.

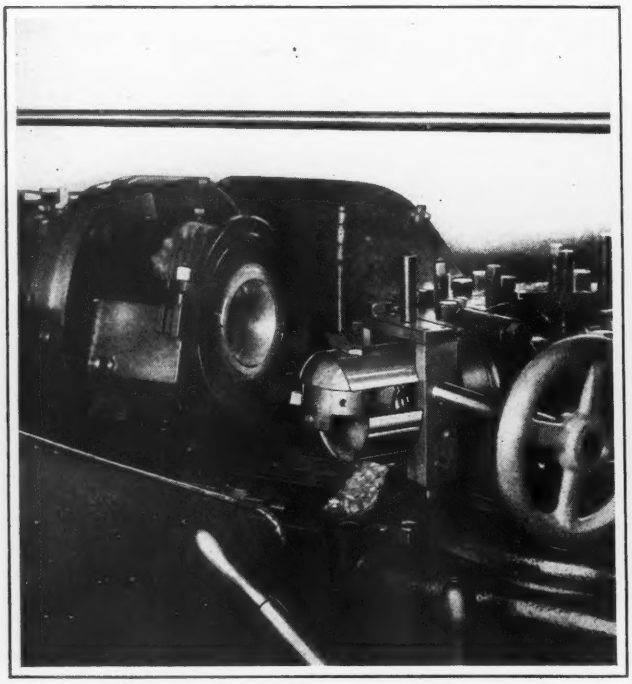


Fig. 10. Turret Lathe Operations on Cylinder Head

Fig. 11. Grinding the Bore of a Cylinder Barrel

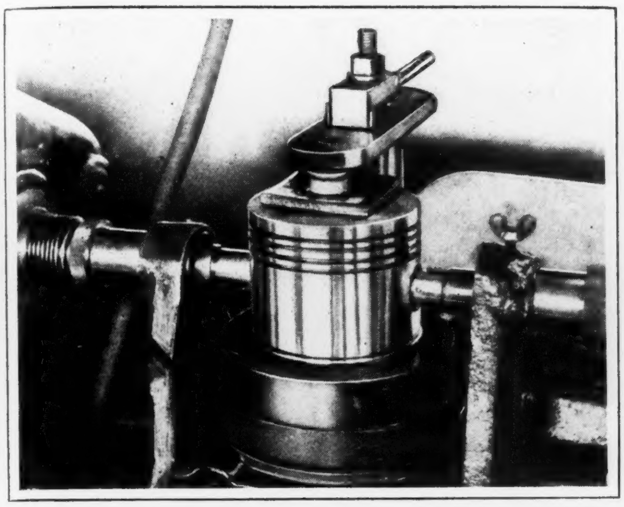


Fig. 12. Boring Piston-pin Hole on Engine Lathe

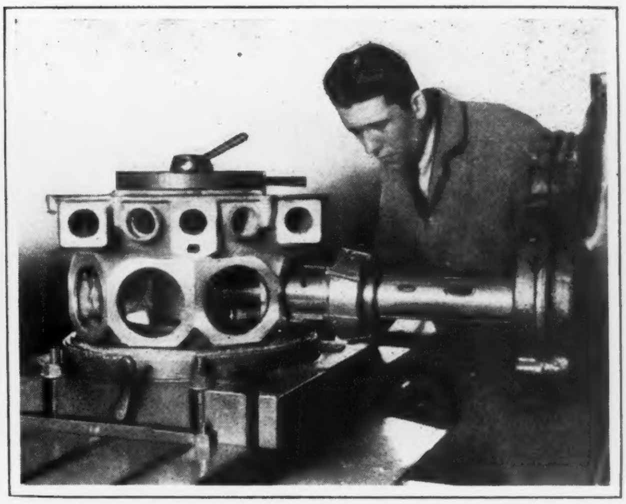


Fig. 13. Boring and Facing Operations on Crankcase

In Fig. 10 is shown a turret lathe equipped for boring, facing, forming the dome and threading the cylinder head. This illustration shows clearly the special radius boring tool which forms the dome portion of the head. The method of boring the piston-pin holes is shown in Fig. 12.

Machining Operations on the Crankcase

The first operation on the crankcase (shown at *A* in Fig. 16) consists of setting up the casting on a special indexing fixture. A special tool *B*, Fig. 16, is used to rough-bore and finish-bore the cylinder pads (see Fig. 13) and also to rough-face and chamfer these pads. The cutter shown at *C*, Fig. 16, is then employed for rough-milling the carburetor pads. The fourth operation consists of finish-milling the carburetor and cylinder pads with the cutter shown at *E*. Next tool *D* is used to finish-counterbore and face the intake manifold bosses. A ground tap *F* is employed to tap the thread in the intake manifold bosses. The production time on this job, which consists of finishing the nine cylinder pads, nine intake bosses and three carburetor pads, is less than two hours. All dimensions are held to limits of plus or minus 0.001 inch.

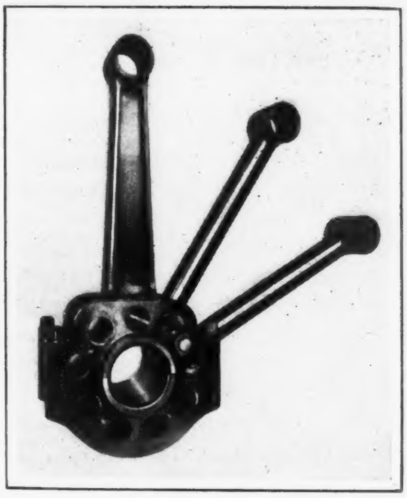


Fig. 14. Master Connecting-rod and Two of the Eight Articulating Rods

Fig. 15. One of Seventy Operations on the Master Connecting-rod

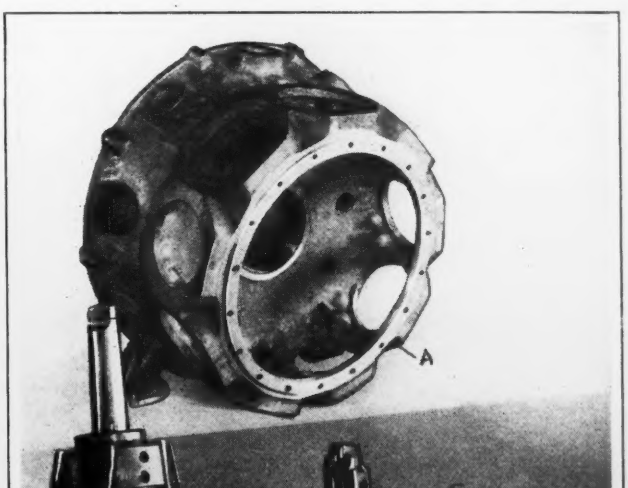


Fig. 16. Tools Used in Machining the Crankcase Shown in Fig. 13

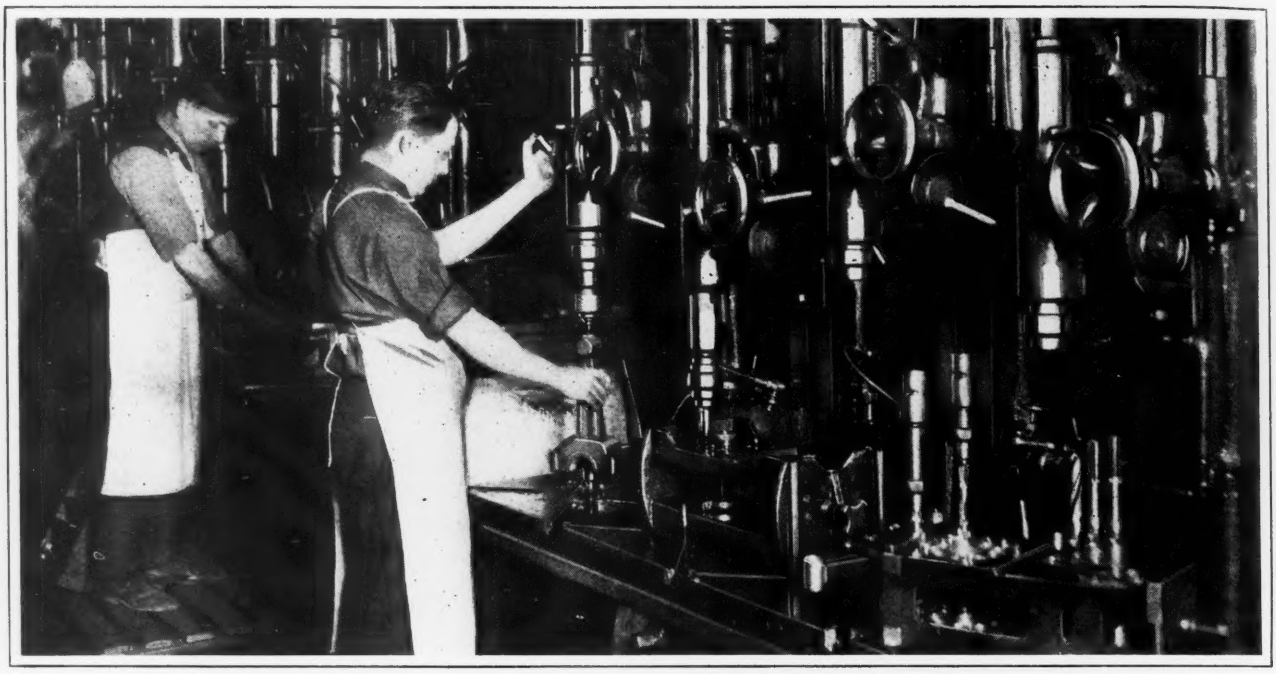


Fig. 17. Gang of Drills and Fixtures Used in Drilling Operations on Connecting-rods

In Fig. 15 is shown one of more than seventy machining operations required in finishing the master connecting-rod shown in Fig. 14. In this particular operation, the end-mill shown on the milling machine table is first used to cut out a half-round groove between the two projecting flanges on the rod. The rod is then located in the fixture as shown. Two cutters are placed in the groove just formed, and an arbor passed through holes in the flanges and the cutters. The cutters, driven by the milling machine spindle, are used to square up the inner faces of the flanges.

Many special fixtures are required to finish the rod all over within the accurate limits required. A gang of drills with some of the fixtures in place is shown in Fig. 17.

In Fig. 18 is shown a centerless grinder set up for grinding piston-pins. In this operation, 0.020 inch of material is removed. The pins are first rough-ground to within 0.005 of their finished size in five passes. The finishing is done in two passes, leaving 0.0005 inch of material to be removed in the final finishing. The limits on this job are plus or minus 0.0002 inch.

Grinding the holes in valve tappet guides, as shown in Fig. 19, is one of the interesting jobs on the hundreds of small parts that are assembled into the engine and that must be held within exceptionally accurate limits. The hole is 11/16 inch in diameter, 2 7/8 inches long, and is held within limits of plus or minus 0.0002 inch. A longitudinal slot extending a good portion of the length of this part serves to make the grinding job one requiring careful workmanship and the right equipment. The automatic grinder employed for this job is equipped with an air-operated chuck. A spindle speed of 1700 revolutions per minute, with a feed of 55 strokes per minute, is used.

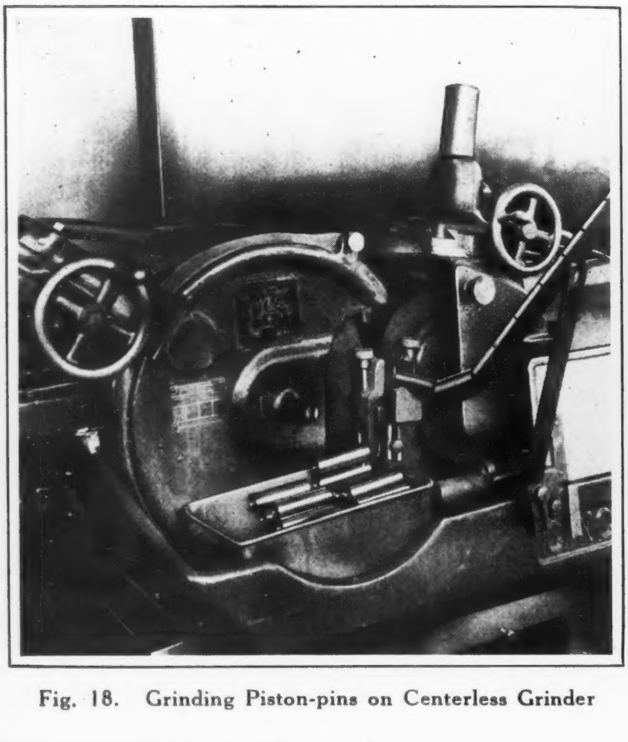


Fig. 18. Grinding Piston-pins on Centerless Grinder

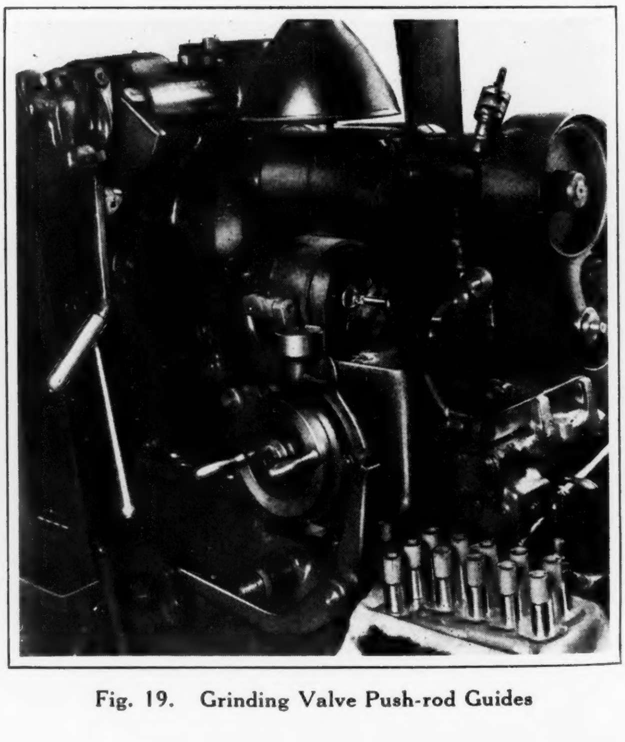
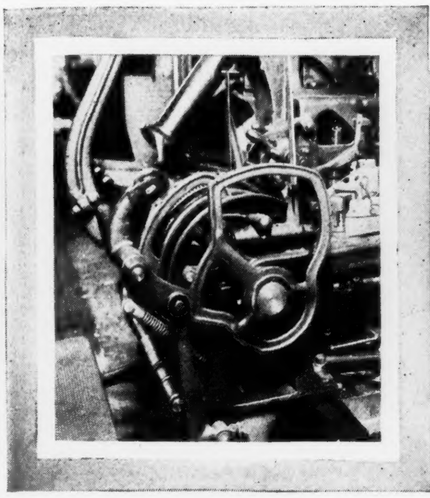
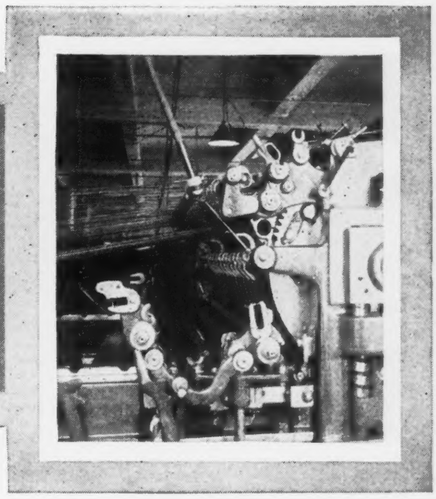


Fig. 19. Grinding Valve Push-rod Guides



Ingenious Mechanical Movements



OVERLOAD RELEASE WITH POSITIVE LOCK

By GUSTAF SANDBERG

Frequently it is desirable, in feeding and other operations, to have a safety device that will function at any time except just before the end of the stroke, when the action must become positive as, for example, when a part is being locked or held solid while it is being operated on by a punch or other tool, after having been pushed into position with the automatic release ready to act in case of any obstruction. The device shown in the accompanying illustration was designed to provide such an overload release and positive lock during the last 1/16 inch of the stroke. In this instance, the automatic release is used in connection with a slide that transmits a tensional or pulling force, but this type of release has also been applied with slight changes where a compressive or pushing force is utilized. Such a mechanism is applicable in conjunction with auxiliary rams or slides of punch presses, and it may also be applied to automatic machines or other mechanisms.

In the particular design illustrated, connection with the source of power is at *A*, and motion is transmitted through link *B* to slide *C* and through the safety device to the point of application at *D*. (In some cases, the operating stroke might be derived from an eccentric at the side of a press or from a crankshaft.) Pivoted to slide *C* is a releasing plate or flap *G*, which is free to swing about its pivot or pin, as indicated by the dotted lines in the lower view. This releasing member *G* normally is held in the closed or driving position by spring *H*. As the end of plate *G* is beveled and engages an inclined surface on the driven part *O*, plate *G* tends to swing upward during the working stroke, but is prevented by spring *H* unless unusual resistance is encountered. The part *O* is in the form of a strap or loop which surrounds plate *G*, as indicated by

Safety Overload Release which Changes to a Positive Drive Just Before the End of the Stroke

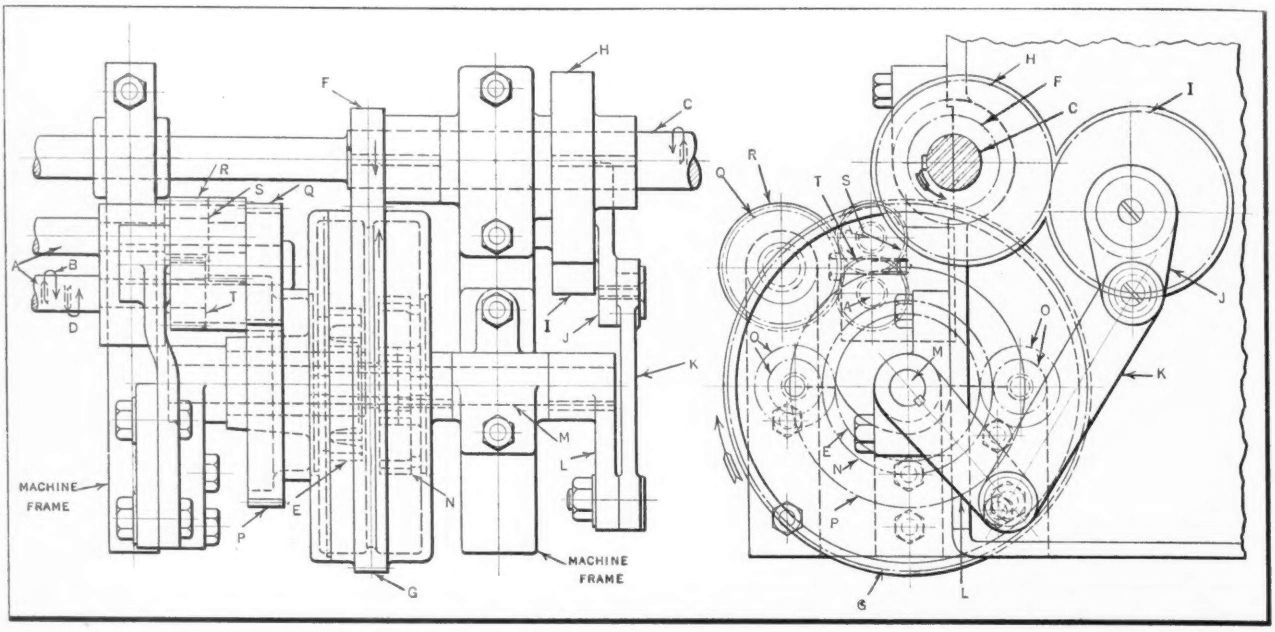


Fig. 1. Special Design of Differential Mechanism for Transmitting to Feed-rolls a Variable and Reversing Rotation

the plan view, and *O* is positively connected to member *D*.

Unless some obstruction or abnormal resistance causes disengagement of the driving and driven part through the release mechanism described, movement of the slide continues in the direction of the arrow until lever *M* strikes projection *Q*, thus releasing the pawl, the location of which is indicated on the side and plan views. As the pawl is instantly forced upward by a spring beneath it, the drive is transferred from the beveled surfaces between parts *O* and *G* to vertical surfaces between parts *O*, *G*, and the pawl, so that the release mechanism is no longer effective and the stroke becomes positive.

During the return stroke, lever *N* strikes projection *R* and withdraws the pawl, so that it is in position for the next forward stroke. The illustration shows the relative positions of the parts just before the pawl is released or tripped. A spring is used to force the pawl upward when released, because this provides the instantaneous action desired.

If during the working stroke an obstruction had been encountered by the driven member, part *O* would have stopped as flap *G* disengaged from it and slide *C* would have traveled forward without injuring whatever tools or other members are connected at *D*. The action should, of course, be timed by properly locating the projections or stops for manipulating the pawl levers. The angle of the bevel between parts *O* and *G* depends upon the amount of force to be transmitted, and adjustment of spring *H* provides a more delicate means of regulating the releasing action.

* * *

VARIABLE AND REVERSING ROTATION FOR FEED-ROLLS

By S. H. HELLAND

The requirement of the mechanism here described, which is used on a cotton combing machine, is to rotate feed-rolls *A* (see Fig. 1) with their respective top rolls (not shown) 1.4 revolutions in the direction of arrow *B* while driving shaft *C* makes 0.6 revolution, and, during the remaining 0.4 revolution of shaft *C*, to rotate feed-rolls *A* 0.7 revolution in the direction of arrow *D*.

The object is to feed approximately 4 inches of cotton forward, as indicated by arrow *B*, and then reverse and feed approximately 2 inches of material backward, as indicated by arrow *D*, and repeat for each revolution of driving shaft *C*, thus performing a doubling process in conjunction with other elements of the machine.

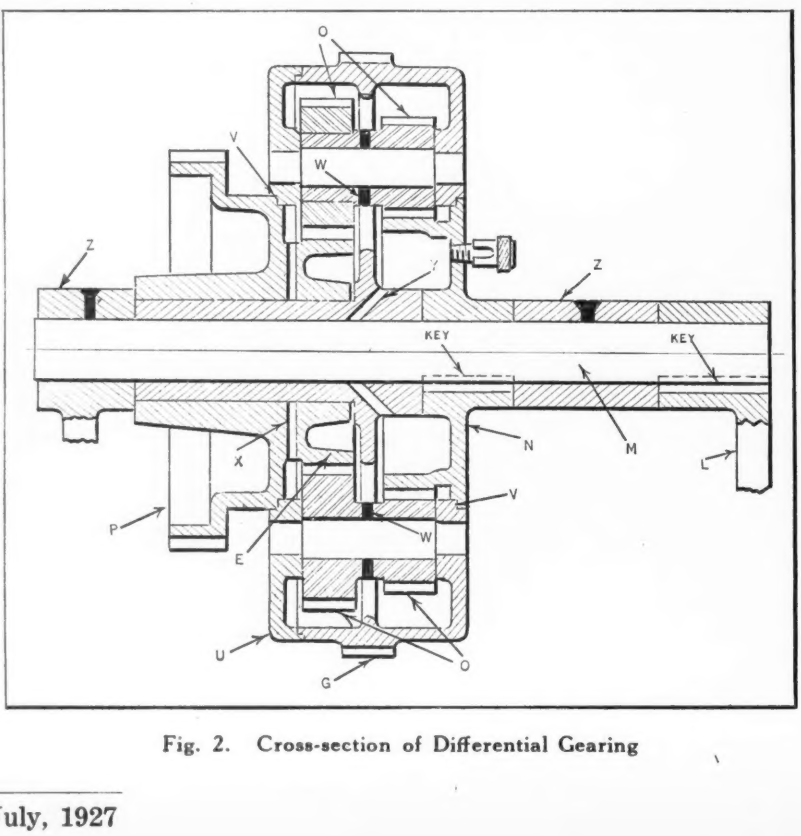


Fig. 2. Cross-section of Differential Gearing

The required result was obtained by combining a constant motion and a variable oscillating motion, the two motions

co-acting on a common gear E (see also Fig. 2) through an epicyclic or differential gearing combination. Referring to Fig. 1, it will be seen that the constant motion is effected by driving pinion F and housing gear G; also that the variable oscillating motion is produced through eccentric gears H and I, crank-arm J, connecting link K, rocker arm L, rocker shaft M, and rocker shaft gear N. Through the planetary gears O these two motions are permitted to combine and drive feed-rolls A forward and backward as mentioned, through gears E, P, Q, R, S, and T.

The timing of the forward and backward rotation of rolls A is controlled by eccentric gears H and I, which transmit a quick-return motion to rocker arm L for the forward rotation of rolls A, as indicated by arrow B, and next a slower motion in the opposite direction to rocker arm L for the backward rotation of the rolls A, as indicated by arrow D. Eccentric gear H is keyed to driving shaft C, while I is keyed to the hub of crank arm J, which revolves on a suitable stud fastened to the frame of the machine.

Housing gear G, which runs loose on rocker shaft M, and all other gears and bearings inside of it, are splash-lubricated through oil-holes X, Y, and W, Fig. 2. By pouring one-half pint of oil into the housing, three weeks' supply of lubricant is provided, which is well distributed to all bearings by planetary gears O revolving through it. Oil-tight joints are provided for gears N and P, as shown at V, Fig. 2. Gears E and P are integral and revolve on the extended hub of housing gear G. Rocker arm L and rocker shaft gear N are keyed to rocker shaft M. Bearings on the machine frame are located at Z. This mechanism replaced a cam and clutch arrangement which was too noisy and did not wear well.

* * *

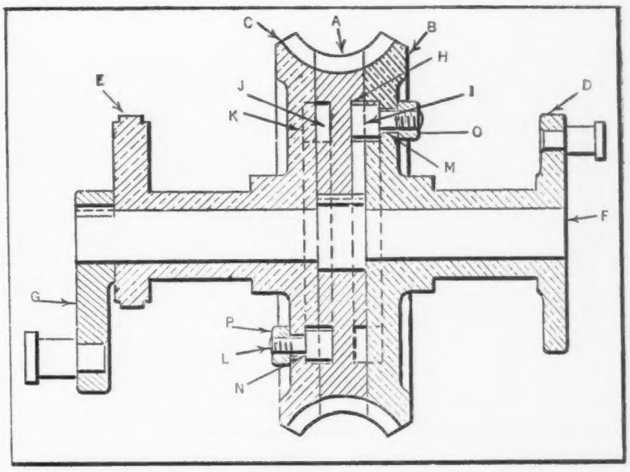
TRIPLE INTERMITTENT WORM-GEAR

By F. C. MASON

The mechanism here described—a German invention—is one of the most novel and interesting that the writer has ever seen. It was part of a barbed wire fence-making machine. While the accompanying drawing of the device is not made to any scale, the description will explain the principle of the design. This device transmits three distinct movements, all of which can have a dwell of different length, and this dwell can be varied in time to at least 180 degrees of the cycle.

The worm-gear is made up on three sections, A, B, and C. Section A is keyed to shaft F; section B revolves on shaft F and carries a disk crank D; section C also revolves on F and has an eccentric E. Shaft F has a crank G, and D, E, and G are the work levers. Worm section A has two concentric slots J and H on each side. In each of these slots there is fastened a stop (not shown). In sections B and C there are two concentric slots M and N cut long enough to meet the required adjustment of timing. Dog bolts L and I are held in the desired position by nuts O and P.

A section of the teeth long enough to make complete disengagement from the worm is cut from A, B, and C. We will assume that section C where the teeth are out is set central relative to the center of the worm; then section C would stay in this position until section A rotated enough to bring the stop in slot J into engagement with dog L. This action, of course, must be timed so that when engagement occurs, the worm teeth will register. By the varied settings of these two dog bolts, the timing of any section can be changed.



Triple Worm-gear for Transmitting Three Intermittent Movements

* * *

NEW TUBE OPERATES ON ONE-BILLIONTH OF AN AMPERE

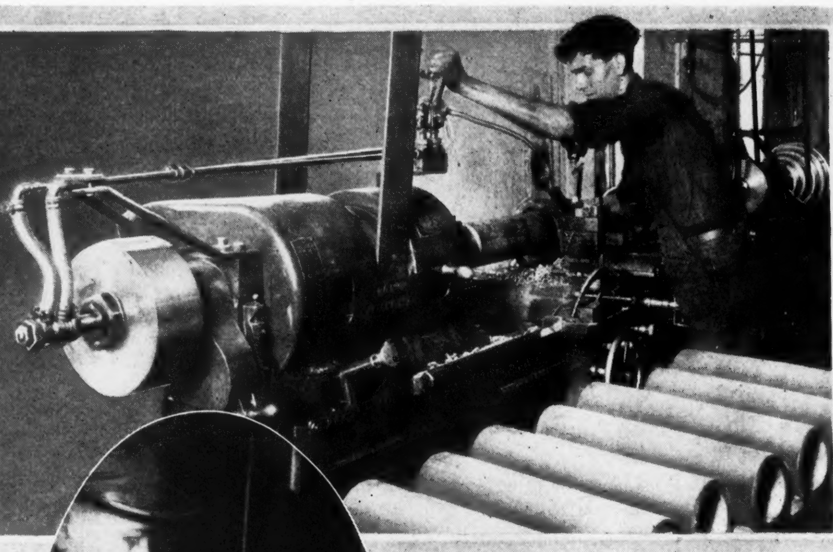
A glow tube so sensitive that the energy from one ounce of coal can operate it 17,000,000,000 times, has been developed by an engineer of the Westinghouse Electric & Mfg. Co. at East Pittsburg. This device is more sensitive than anything yet developed in electrical research, operating approximately on one-billionth of an ampere.

The "grid controlled glow discharge tube," as it is termed, which was perfected by D. D. Knowles, is so sensitive that a human hand placed near a grid plate is sufficient to operate it. This act causes the tube to glow and discharge energy sufficient to actuate a relay. Analyzed briefly, this device consists of three electrodes—a negative electrode and a positive electrode, the latter being surrounded by a grid which constitutes the third electrode. Differing from the ordinary vacuum tube, this glow tube has no heated filament, and therefore does not consume any energy when not operated. If a voltage is applied between the positive and negative electrodes, particles of electricity called "free electrons" attach themselves to the grid. When this grid is thoroughly insulated, these minute charges of electricity cannot escape, thus preventing the tube from passing any current. When a spectator's hand is placed near the plate, a means is provided for removing the small charges of electricity. The result is that the tube immediately passes a current large enough to operate commercial relays.

Several important commercial applications are as follows: Fire protection; when used for this purpose, the smoke or flame would serve to operate the tube. Burglar alarm; the grid of the tube can be attached to desk, window, drawer, or vault, and as soon as the tube is touched, it operates a relay. Gas furnace flame control; serving in this agency, the glow tube would insure that the pilot flame was kept burning. Other uses include automatic gaging of the depth of oil or water tanks.

Air Chucks and Fixtures

Pneumatically Operated Equipment Designed to Save Time and Labor in Quantity Production



**Indexing Fixtures
Assembling Fixtures
Bar Chucks**

NUTS may be rapidly castellated by means of the indexing fixture shown in Fig. 1, in which six nuts are held at one time while being milled by three cutters mounted on the arbor of a milling machine. Each cutter mills two slots in two nuts at every movement of the fixture past the cutters, and the fixture is indexed 60 degrees between each traverse, so that only three movements past the cutters are required for milling six slots in all the nuts. The nuts are placed in the fixture with two sides in contact with two of the stationary jaws *A* and one side in contact with one of three central hinged jaws *B*.

When the nuts have been assembled in the fixture, air is admitted into space *Y* of the cylinder, forcing piston *C* toward the right. This movement causes wedge *D*, attached to the front end of the piston-rod, to expand jaws *B* against the nuts and thus force the nuts securely against jaws *A*. When air is admitted into space *Z* of the cylinder, the piston is forced toward the left and the nuts are released.

Spring plunger *E* enters taper-hole bushings spaced around the

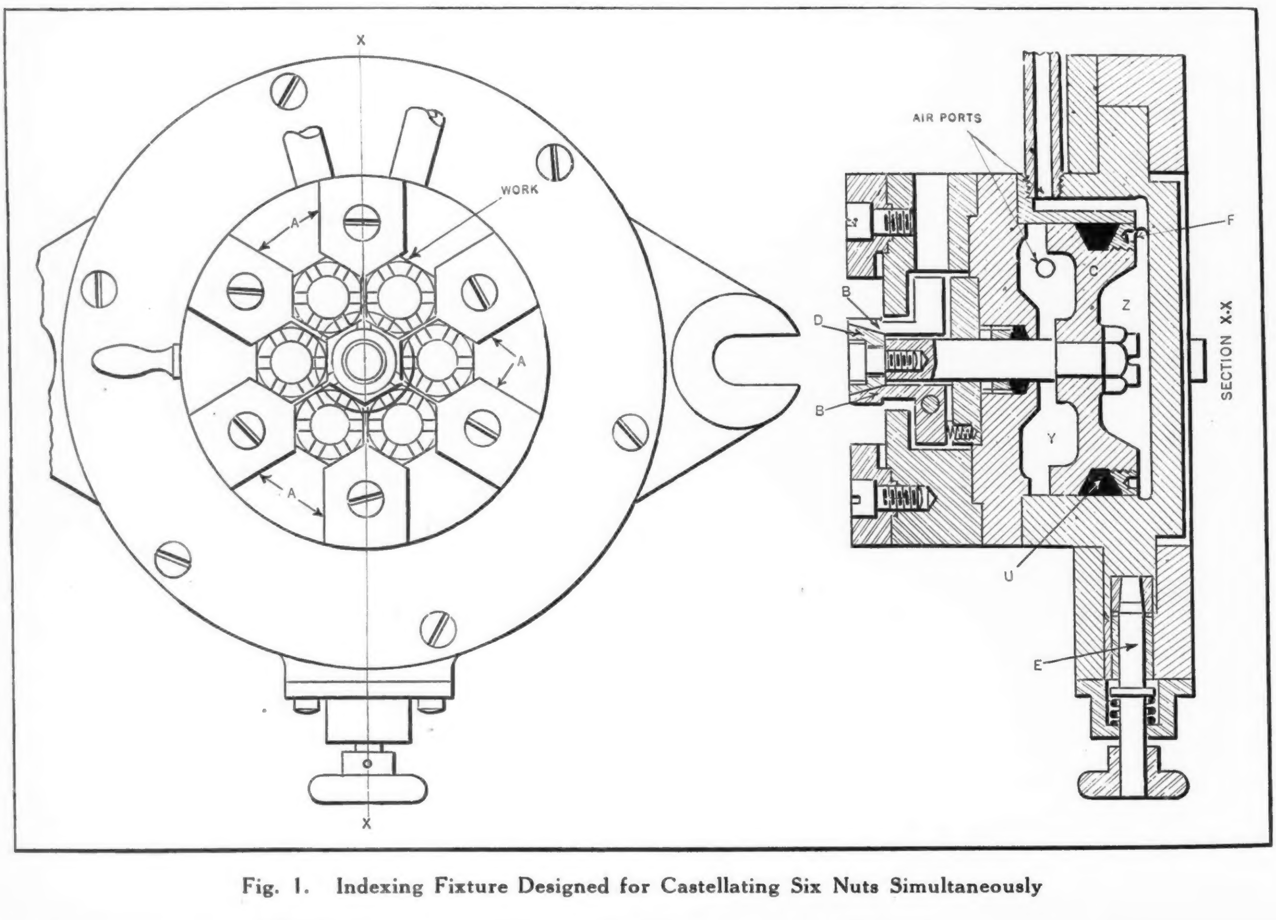


Fig. 1. Indexing Fixture Designed for Castellating Six Nuts Simultaneously

cylinder, in order to hold the cylinder in the various indexed positions relative to the fixture base. Packing *U* is tightened by screwing up nut *F* with a spanner wrench applied to holes provided in the outer face of the nut. This fixture and all other devices described in this article were built by the Hannifin Mfg. Co., Chicago, Ill.

Steering Arm Jig and Chuck

Four automobile steering arms are drilled through the boss at one end while held in the jig illustrated in Fig. 2, which was developed for use on an upright drilling machine. The boss end of each arm seats on a hardened and ground block *A*, and is forced against the V-sides of four blocks *B* by equalizing bars *C*. These bars are fastened to a block *D* which slides horizontally in a guide according to movements imparted to it by link *E*. The lower end of this link is connected to the rod of a piston which operates in cylinder *F*. It will be obvious that the four steering arms are gripped in the jig with equal pressure when the air valve lever is operated to admit air into the cylinder so that the lower end of link *E* is moved toward the right. The cams are, of course, released when air is admitted into the cylinder on the opposite side of the piston to move the lower end of link *E* toward the left.

Cylinder *F* is hinged at *X* so that pivot pin *G* of link *E* is free to travel in a true horizontal plane with bar *D*. Chips and lubricant flowing from the work pass through hole *Y* in the base of the jig. Jigs of the same general design have been built for drilling parts simultaneously at both ends.

Fig. 3 shows a lathe chuck designed for holding the same steering arm while one end is being turned. The hole previously drilled in the arm is slipped over a ground stud *A* for locating the work. This stud is mounted on movable jaw *B* of the chuck which is operated in synchronism with jaw *C* through a standard air cylinder and piston. After the work has been located over stud *A*, it is firmly gripped, as the two movable jaws approach each other, between jaw *B* and the hinged jaw piece *D*. Member *D* is of a design which equalizes the gripping pressure on the boss and shank of the steering arm.

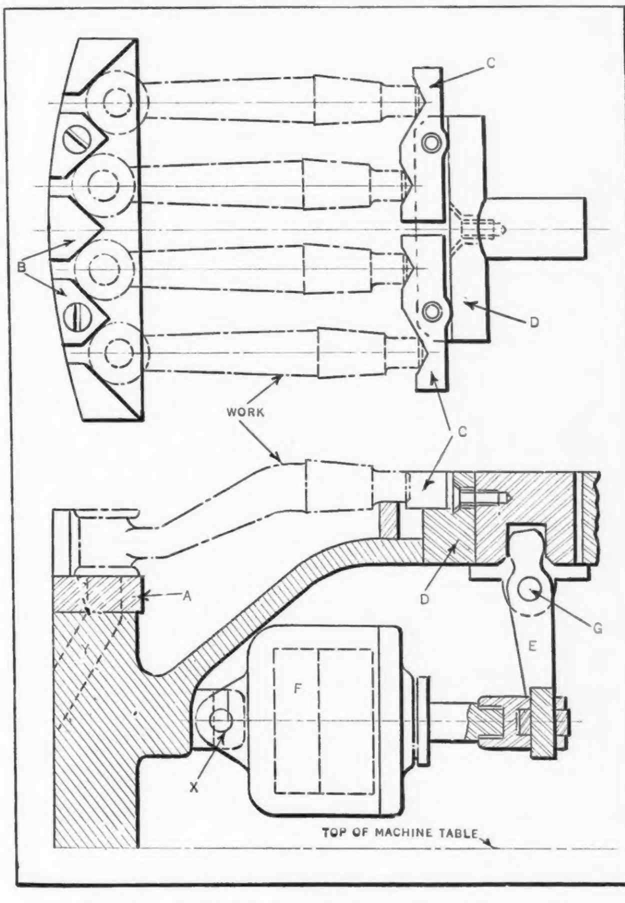


Fig. 2. Drill Jig for Holding Four Automobile Steering Arms

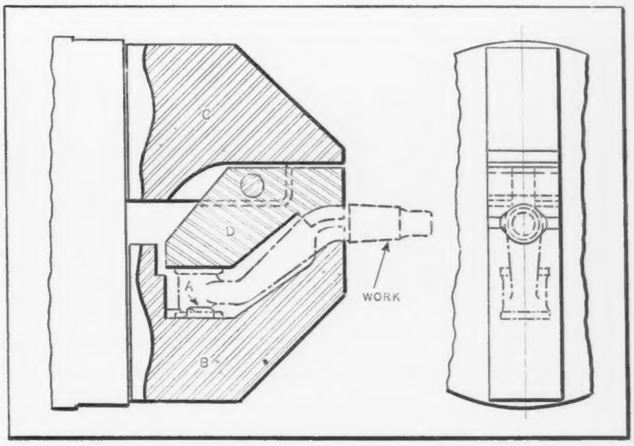


Fig. 3. Lathe Chuck in which Automobile Steering Arms are Held while Turning the Shank

Fixture for Assembling Bushings in Crankcases

Three bushings are assembled in the upper half of an automobile crankcase by means of the equipment illustrated in Fig. 4. The crankcase is properly located on base *A*, and then all three bushings are pressed into place by means of bar *B*. This bar is moved horizontally by piston-rod *C* when piston *D* is operated either back or forth within air cylinder *E*.

The bushings are assembled in bearings *X*, *Y*, and *Z* of the crankcase; thus it will be obvious that an excessive stroke of the piston would be required if bar *B* and rod *C* were unchangeable in their longitudinal relation. To reduce the piston stroke to a minimum, bar *B* is made to slide easily within rod *C*, and the bar is provided with flats *V* at three different points. A C-washer *F* may be slipped over each pair of flats to hold bar *B* in any of three positions relative to rod *C*. Thus, for assembling a bushing in bearing *X*, washer *F* is slipped over the right-hand pair of flats, and air is admitted into the cylinder to force the piston-rod *C* and bar *B* toward the left, the bushing being mounted on the nose of bar *B*.

For assembling a bushing into bearing *Y*, washer *F* is removed and bar *B* is pulled toward the right until the intermediate pair of flats *V* is just in front of rod *C*. The washer is then slipped over this pair of flats, and the bushing is assembled in the same manner as the previous one. At the completion of this step, the washer is again removed, and bar *B* withdrawn until the left-hand bar of flats is just in front of the end of rod *C*, after which the washer is replaced for assembling the bushing into bearing *Z* of the crankcase. Cylinder *E* has a 16-inch bore, and with a line pressure of 80 pounds per square inch, a pressure of 16,000 pounds is exerted on the piston. The piston stroke is 4 inches.

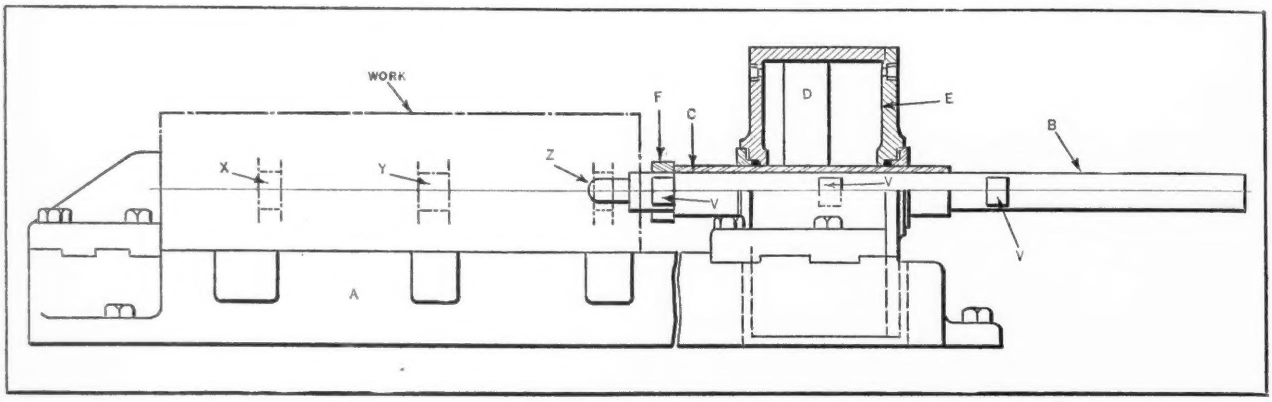


Fig. 4. Fixture Employed in Assembling Three Bushings in a Straight Line in Automobile Crankcases

Fig. 5 shows a somewhat similar equipment for pressing two bushings into an automobile crankcase. In this example, however, one bushing is assembled into a bearing at X and the other into a bearing at Y, at right angles to the first bearing and in a plane 2.286 inches lower. To assemble both of these bearings, it was necessary to provide a means of indexing table A on which the work rests, and also of raising and lowering the table.

Indexing of the table is effected by a conventional mechanical means, but raising and lowering are accomplished through the provision of cylinder B and piston C, the piston-rod being fastened direct to table A. This cylinder has a bore of 8 inches. In its upward and downward movements, the table is accurately guided by posts D which slide in bushings attached to the cylinder base. Stops J control the upper position of the table.

Assembly of the bushings is performed by means of bar E and a C-washer F, which are actuated by the hollow rod of piston G. Cylinder H in which this piston operates has a 16-inch bore, and also develops a pressure of 16,000 pounds on the piston with a line pressure of 80 pounds per square inch.

Two devices that were constructed for clamping large castings weighing approximately 1800 pounds each to the table of a drilling and tapping machine are illustrated at Y and Z, Fig. 6. While both of these devices actually work in unison, the illustration shows clamp A of device Y in place on a ledge of the work, and clamp A of device Z withdrawn from the work, in order to make the operation clear. The two devices are arranged for clamping surfaces at different heights.

The work is placed on the table by means of a chain hoist, and when the loading is in process, both clamps A are withdrawn about 2 1/4 inches, as represented by dimension X in view Z. When the work has been properly located, a lever is operated to admit air simultaneously into cylinders B for lowering pistons C. This movement of the pistons causes bellcrank levers E to swivel and pull links F forward and upward. Links G, in turn, are pulled forward, thus forcing clamps A into position on the casting. Links H are connected to the piston-rod at one end and to the clamp at the other, and hence assume vertical positions with links G.

The forward movements of clamps A, and also their return movements, are effected with a jerk in a manner analogous to the operating principle of disappearing guns. The quick jerk is obtained by providing a slot in links F instead of a small

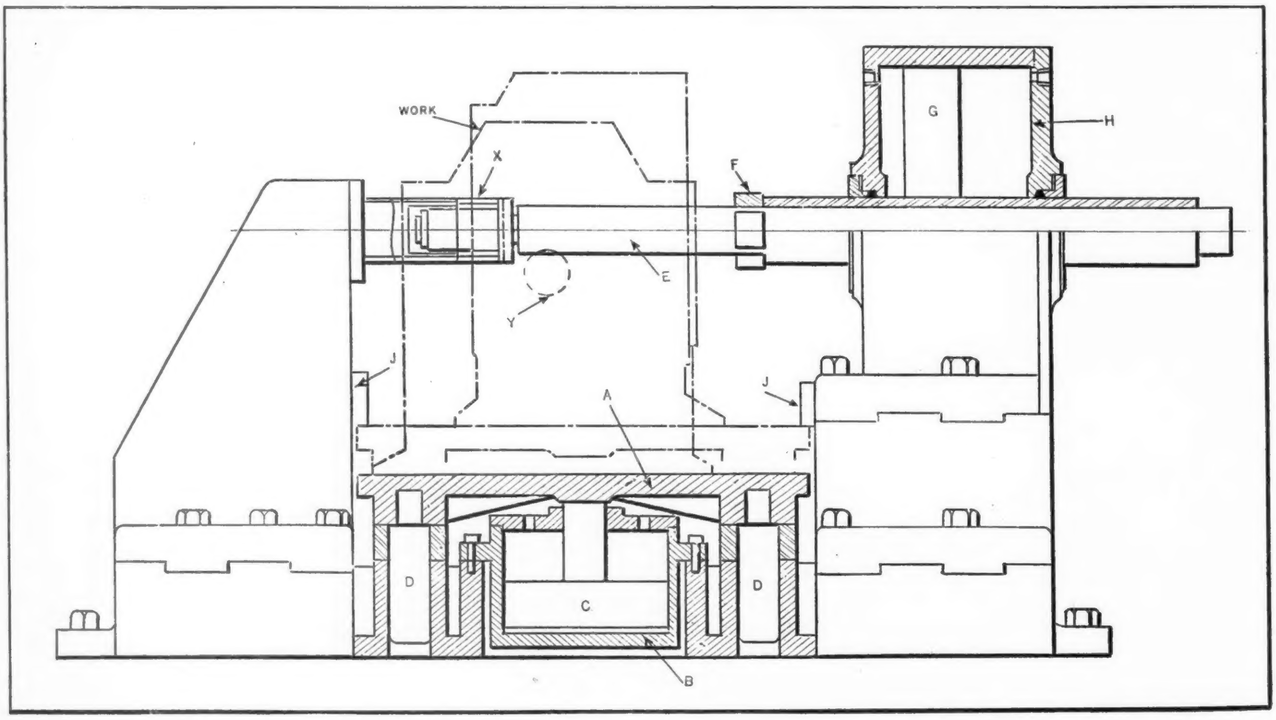


Fig. 5. Fixture for Assembling Two Bushings at Right Angles to Each Other and at Different Heights in Crankcases

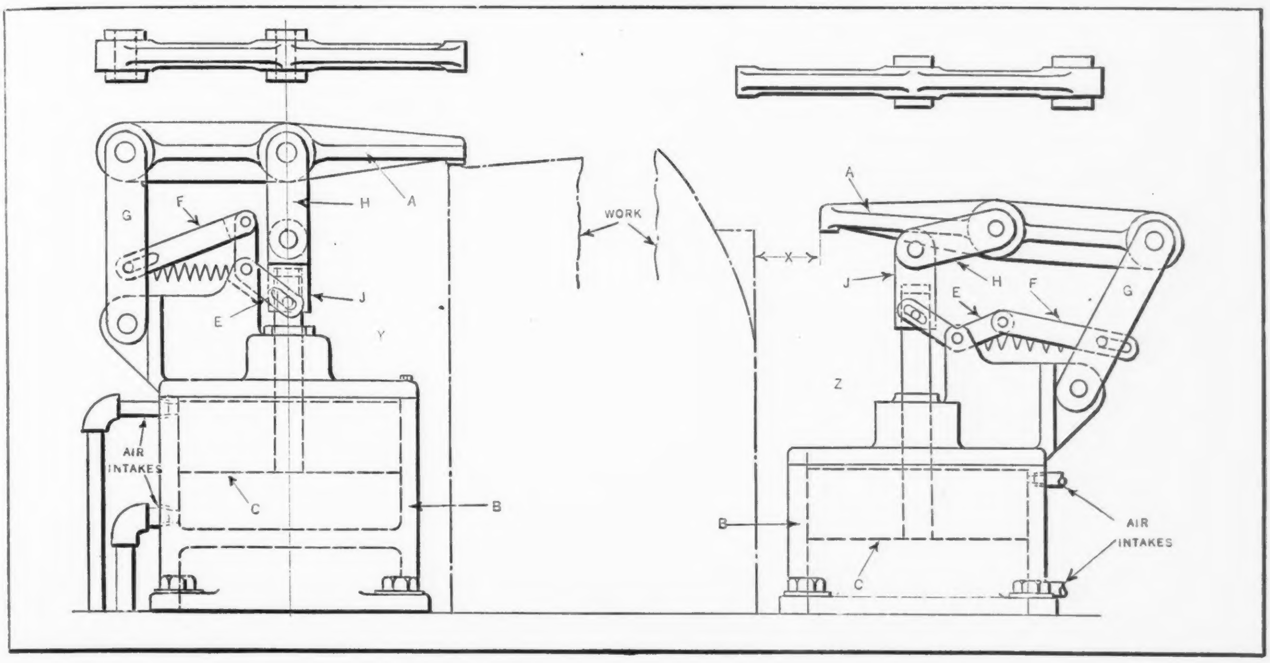


Fig. 6. Air-operated Clamps Used for Holding Heavy Castings on the Table of a Drilling and Tapping Machine

hole, to receive the connecting pin of link *G*. Air is admitted below pistons *C* to release the clamps, the mechanisms then working in the opposite manner to that outlined. The pistons are given a vertical stroke of about 2 inches to move the clamps horizontally 2 1/4 inches. The height of the clamps may be adjusted by means of the screw connection between the piston-rods and sockets *J*.

Bar Chuck for Turret Lathes

In Fig. 7 is shown a chuck designed for holding bars 1 7/8 inches in diameter by 12 inches long in a turret lathe. It will be seen that the greater portion of the work is inserted into a sleeve *A*, the rear end of which is tapped to receive the front end of the piston-rod. The work is pushed into the sleeve by means of a plug on one face of the turret, until the turret carriage reaches a stop. When the carriage comes in contact with the stop, dimension *X* is equal to 1 1/2 inches, and the chuck mechanism is then operated to grip the work with this amount of projection in front of the three false jaws *B*. Spring-actuated plunger *C* holds the work firmly against the turret plug.

When air is admitted into the cylinder of this equipment to grip the work, sleeve *A* is pulled toward the left, causing three bellcrank levers *D* to swivel and force jaws *E* toward the work, actual gripping being accomplished by means of false jaws *B*. To release the work, sleeve *A* is operated toward the right. (The first article of this series was published in June MACHINERY, page 761.)

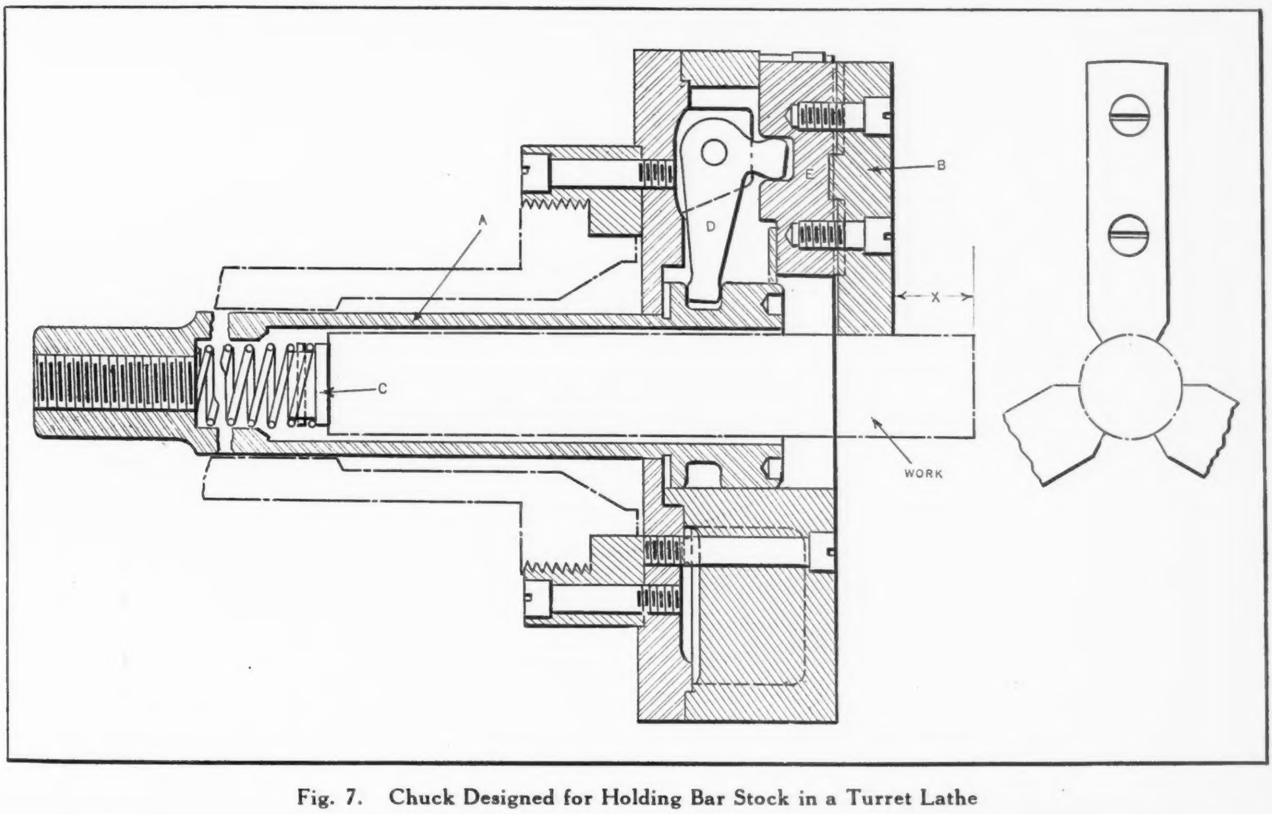


Fig. 7. Chuck Designed for Holding Bar Stock in a Turret Lathe

Machining Casting with Lobe-shaped Bore

By J. E. FENNO

THE fixtures and tools described in this article were designed for machining operations on exhaust pump casings like the one shown in Fig. 1. These parts were required to be produced on a high-production basis, and were routed through the shop in large lots. The first operation consists of facing the flanges and turning and facing the hubs on both sides. Referring to Fig. 3, the work is shown mounted on a three-jaw universal chuck equipped with special jaws, one of which is shown at *B*. These jaws are designed to clear the facing tools *F* and *H*.

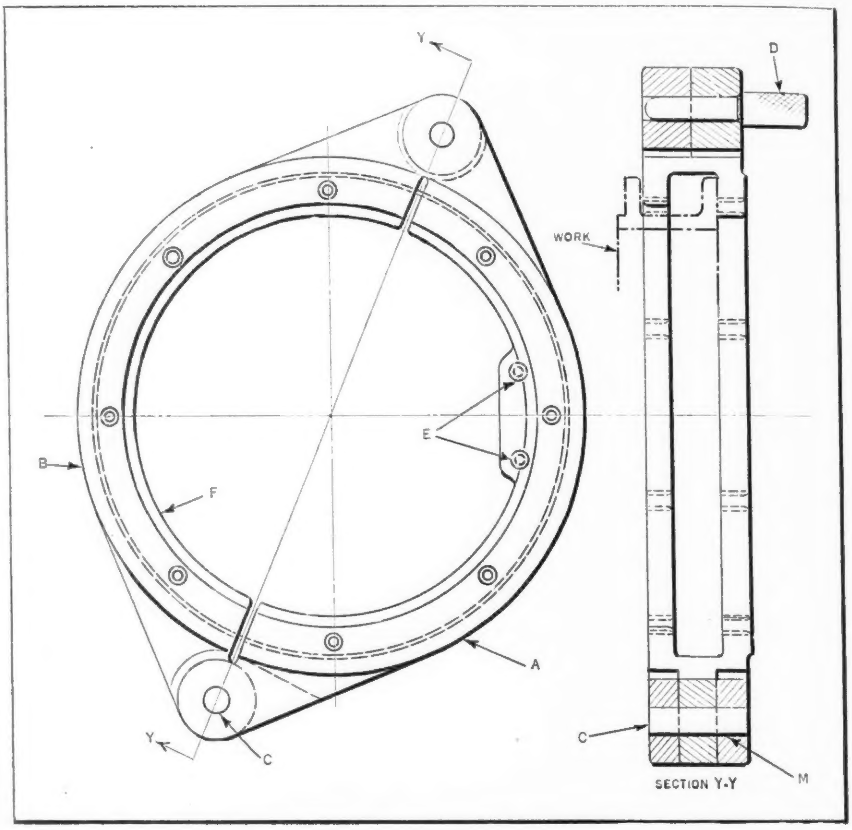


Fig. 2. Jig for Drilling Casting shown in Fig. 1

Squaring Work in Chuck

The work is first placed in the chuck and the jaws brought up lightly. Next, the turret is fed forward by hand until the faceplate *C*, which is fastened in one of the turret stations, comes in contact with the face of the work. A further movement of the turret carries the work against a stop on the machine. This method of squaring the work insures rapid handling and positive location of all pieces in the same position relative to the cutting edges of the tools. After the work is squared up, the jaws are tightened. All cutting tools are fastened to the cross-slide, the roughing cutters *F* and *G* being fed in to the required depth first, after which the tools *H* finish the flanges and turn the hubs to size. As the faces of the hubs have a clearance in the assembled product, they require only a roughing cut.

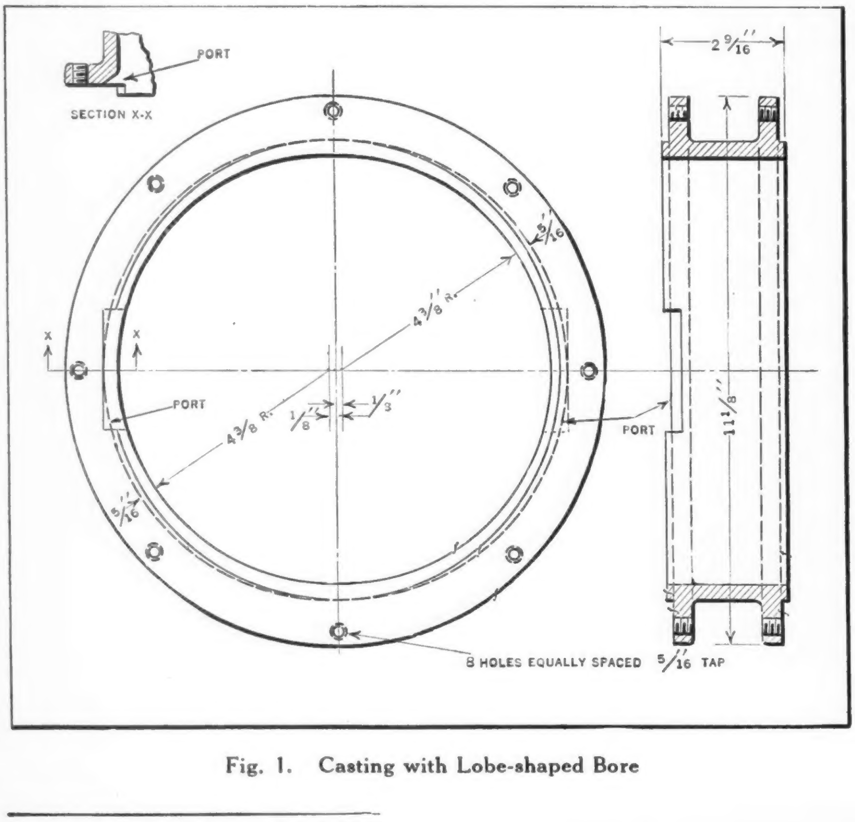


Fig. 1. Casting with Lobe-shaped Bore

Construction of Fixture for Machining Lobe-shaped Bore

The lobe-shaped bore, indicated by the 4 3/8-inch radius dimensions, Fig. 1, is machined in the fixture shown in Fig. 4. The auxiliary faceplate *A* for holding the work is bolted to the faceplate of the turret lathe. The tool-holder *B* is in the form of a dovetail slide fitted in the casting *C*, which is secured to the face of the turret by four cap-screws. The sliding movement of holder *B* required to produce the lobe-shaped bore in the work is effected by the cam *D*. A machined plug *E*, cast integral with part *C*, serves to center this member on the turret face.

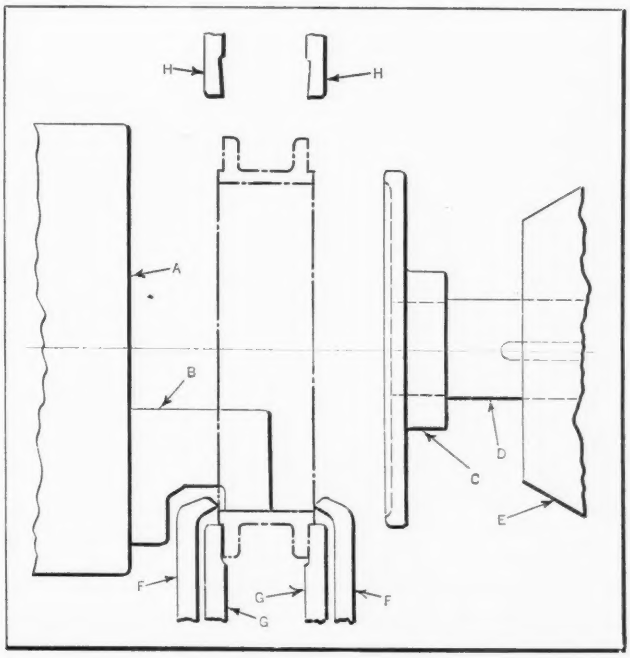


Fig. 3. Method of Chucking and Squaring Work for Turning and Facing Cuts

The camshaft F is a running fit in the bushing G, which is a press fit in member C. Shaft F is also a sliding fit in the bushing H, which is a press fit in A. Bushing H is also securely fastened by screws and dowels. This bushing is of hardened tool steel, and has a solid key which engages the keyway in shaft F. The cam D, which is integral with the shaft F, rides upon the roller I. Roller I is a free fit on the shoulder stud fastened in toolholder B, which is a sliding fit in block C. Holder B has an elongated hole in it, as shown in section X–X, which clears the shaft when the slide moves in and out during the machining of the lobe-shaped bore. The coil spring J acts against a cast lug on the holder and also against a lug on block C, thus taking up all backlash in the mechanism.

Holder B is designed to hold the cutting tools K and L, which are secured to plate M by four hollow-head set-screws (not shown). Plate M, in turn, is attached to holder B by four fillister-head screws. The dust plate N, fastened to the holder, prevents dirt and chips from interfering with the functioning of the mechanism.

Operation of Lobe-turning Fixture

For machining the lobe-shaped bore, the work is loaded on the fixture shown in Fig. 4, with the rabbet serving to centralize the casing in the plate P. The clamps Q are then tightened down, and the work is ready to be bored. The turret is first brought forward until the end of the shaft F partly enters the fixture bushing and rests lightly against the end R of the key in bushing H. Then the spindle is rotated by hand until the keyway is opposite the key. The turret is next moved forward, causing the full length of the key to engage the keyway.

The operator now starts the machine, and the cutters K and L, which have been previously set,

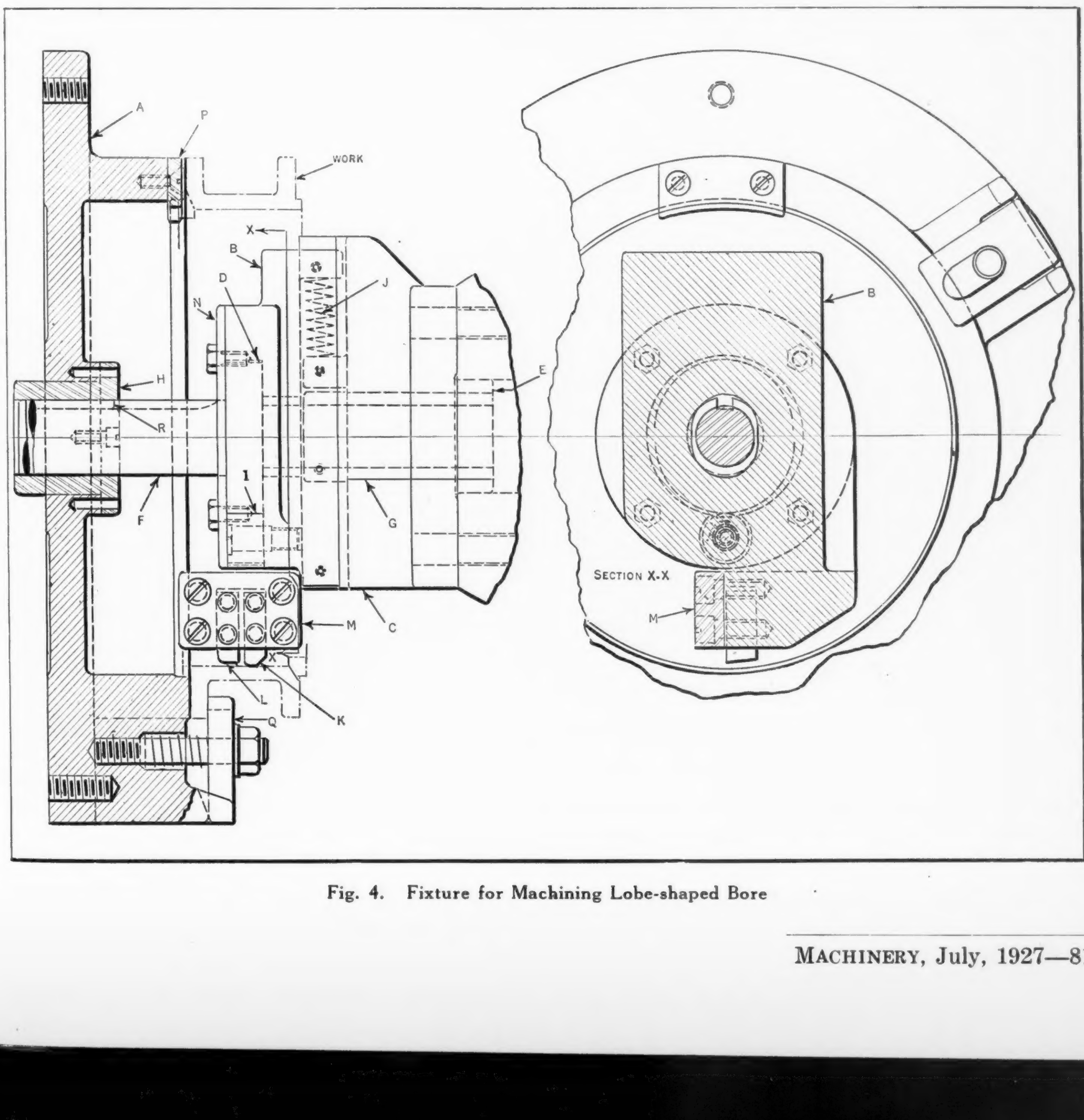


Fig. 4. Fixture for Machining Lobe-shaped Bore

commence to cut into the work. The tool *L* roughs out the casting while the tool *K* takes the finishing cut. Cam *D* is designed to impart the reciprocating motion required to produce the irregular or lobe-shaped bore indicated in Fig. 1.

Drilling the Casing

After the boring operation has been performed, the holes indicated in Fig. 1 are drilled on a multiple drilling and tapping machine. The jig used for the drilling operations is shown in Fig. 2. The construction of this jig is such that it permits the sixteen holes in the flanges to be drilled at one setting, thereby eliminating the necessity for turning the work over and resetting. The two halves *A* and *B* of the ring are hinged on the pin *C*. On the side opposite the hinged pin is the pin *D*, which is used to lock the fixture in place over the work. The cast lug on one half of the ring carries the two pins *E* which enter the ports in the casting and act as locating means for drilling the holes in their proper positions.

The finished bore *F* fits over the rabbet on the work, thus centralizing the piece. After the holes are drilled, the jig is removed from the work, which is then placed under another set of spindles provided with taps. The tapping operation completes the part, which is then ready to be sent to the stock-room.

* * *

ELIMINATING THE BUSINESS CYCLE

In an address before the National Industrial Council, Gilbert H. Montague pointed out that six years ago, "business cycles" were deemed to be humanly uncontrollable, and almost as inevitable as the tides. Today, business men to an unprecedented degree, are themselves prolonging our national prosperity, by self-imposed cautions and other controls. To avert extravagance, inflation, inefficiency, and all the other wastes that come with business booms, and to avoid unemployment, cancellation of orders, contraction of credit, and all the other ills that come with business slumps is a humanitarian achievement of the highest order.

Uncertainty, strain, anxiety, unsettlement, and loss of morale have for generations been the toll that "business cycles" have levied on men and women in every station of national life. To prolong the "business cycle," to lengthen the swings between business prosperity and business depression, to raise the valleys and lower the peaks of business activity, and to substitute reasonably continuous well-being for alternate feast and famine in industry are accomplishments that make cheerful business men, happy and contented working people, and higher standards of life and enjoyment throughout the whole scale of civilization. How quickly such a population and such a civilization can pile up wealth and social values is the miracle that today America is showing to the world.

The most effective control is the collection and dissemination of trade information, by which manufacturers and distributors individually may be enabled to conform their production and distribution to the known facts of total consumption, total output, total orders, and total stocks on hand throughout the country.

WHAT THE PRODUCTION MAN GETS OUT OF A MACHINE TOOL EXHIBITION

By EUGENE BOUTON, Chandler-Cleveland Motors Corporation, Chairman of the Production Advisory Committee of the Society of Automotive Engineers

The advantages to a production man of attending a machine tool exhibition are so numerous that it would be a lengthy task to enumerate them all. In the writer's opinion, some of the most important advantages are as follows:

1. He has an opportunity to see, in operation, the latest types of practically all classes of machine tools used in the metal-working industry.

2. He can make comparisons of competing lines of equipment, study their particular features, ask questions, and form an opinion as to the particular machine that would best fit the needs in his shop.

3. He does not have to rely solely on the salesman's presentation of a machine or on catalogues and other sources of information about the equipment. He actually sees the machine he is most interested in engaged on regular production work, the same as it would be in his own plant.

4. The application of other types of equipment to his work—applications that he may never have thought of before—are brought to his attention. He learns of new machines adaptable to his own particular line of manufacture.

5. Exhibitions broaden his knowledge of machine tools, and he gets new ideas as to their design. The future possibility of a machine that he sees will occur to him. The special features of auxiliary equipment and specialized applications become evident to him in a way that would be impossible under any other conditions.

6. In addition to having the opportunity of observing the machine tools in operation and discussing their features with the representatives of the machine tool manufacturers, the exhibition is a meeting place for all production men in the industry. They usually discuss among themselves the merits of each particular type of machine, and its application in their own factory. What better information could a production man gather than the opinions of others on the operation of the machines that he must pass upon in making selections of equipment for future use?

7. Some of the engineering societies hold production meetings at the same time as the exhibitions, at which papers on engineering and manufacturing subjects are presented and discussed. The production man has the opportunity of attending these meetings in connection with the exhibit, so that his time is fully occupied when not attending the machine tool exhibition. The papers at these meetings are of the highest order, dealing with the most modern and improved methods in manufacturing. The discussions following the reading of the papers are of vital interest to every production man. He is free to ask questions of particular interest to him and thus obtain information that cannot be obtained in any other way.

8. If the production man obtains an idea while attending a machine tool exhibit or any of the engineering society meetings, the application of which will effect a saving of only $200 a year, it will more than offset the cost of attending.

The British Metal-working Industries

From MACHINERY'S Special Correspondent

London, June 17, 1927

THE position of the metal-working industries of the country shows little change, on the whole, but there are distinct signs of progress in certain branches. A close investigation reveals the fact that nearly all sections are working at normal pressure, while several branches, such as the steel making, shipbuilding, and electrical industries, are fully occupied and will be for some time to come. The reaction is only beginning to be felt by the machine tool industry, which is always the last to feel the effects of prosperity. It is a healthy sign that the unemployment figures continue to decrease, being now under the million mark, a point they had just reached at the beginning of the coal stoppage last year.

Iron and Steel Production Increases

Great Britain's share of the world's total steel production was 10 per cent in 1913, but this dropped to slightly over 4 per cent last year. So far this year the world is making steel at the rate of considerably more than ninety million tons for a full year, which would be at least fourteen million tons more than in 1913, and the British share of the year's total world output promises to be about 12 per cent, or 2 per cent higher than in the last full year before the war. In March this year, the British steel output achieved a new record of 949,600 tons for the month.

This record output of steel is concurrent with diminished exports and greatly increased imports. In other words, the home consumption of steel is much greater than the production figures alone indicate. There was a time when two-thirds of British-made steel was exported. Now we are using more steel than we send out of the country.

Outlook Brighter in the Machine Tool Industry

Machine tool makers generally report only fair business, more encouraging reports coming from the Manchester and Midlands districts. Here a good volume of work is in progress. There is evidence of more orders being placed after rather a quiet spell and, taken on the whole, business in the machine tool industry seems to have progressed slowly during the year. It is in the heaviest classes of machines that the least headway has been made, no doubt on account of the large capital outlay involved. The outlook for the future is certainly brighter, and inquiries are good.

Overseas Trade in Machine Tools Falls Off

The April export returns of machine tools show a falling off, but probably the Easter holiday accounted in some part for this. The exports since last July have, however, fluctuated considerably each month, and a true appreciation of the trend of business cannot be obtained from a consideration of one month's figures.

The exported tonnage of machine tools dropped from 1320 in March to 791 in April, with a corresponding drop in value from £146,717 to £99,660. The ton-value rose, however, from £111 to £126. Imports during the same period rose from 460 to 804 tons in April, the value increasing from £83,903 to £113,123, the highest figure for a considerable period. The ton-value dropped from £182 to £141, which is now almost at its recent average level of £130.

The exports of small tools and cutters during April dropped from £51,259 in March to £43,097. The tonnage of machine tool exports and the value of small tool exports were the smallest for any month in the last three years. Lathes accounted for about one-third of the value of exports, drilling machines coming second with one-seventh, and grinding machines forming one-twelfth of the total. Grinding machines, however, formed over one-quarter of the value of the imports, with lathes a poor second at one-sixth.

Electrical Engineering Field Active—Shipbuilders Busy

Electrical engineers are all fully employed, and have received a number of very important contracts during the last few weeks, chiefly for the electrification of foreign railways. Important contracts have also been placed from abroad for cables, switchgear, and power house equipment.

The shipbuilding and allied industries are still very busy, and prospects are good.

Railway and Automobile Industries Report Progress

Railway engineers are a little busier, a few good orders having been received from abroad, for example, one for ten locomotives for the Central Argentine Railway. Railway car builders are steadily employed, many on outstanding foreign contracts.

The automobile industry is in excellent condition. The output last year was 160,000 cars, of which some 6000 were exported. About 5200 imported cars were retained in Great Britain; this figure is insignificant beside the balance of 154,000 British cars sold in the home market. Two-thirds of the cars now registered are of 14 horsepower, and under, so that it is clear that the industry has developed rapidly of late by concentrating on the small car and improving manufacturing methods.

* * *

The Census of Manufactures of the United States shows that for every industrial worker in the country an invested capital of over $5000 is required—this being the average for all industries. For every worker employed, power equivalent to 4 horsepower is also supplied. The great earning power of American labor depends to a large extent upon the machinery, equipment, and power appliances employed.

Current Editorial Comment

in the Machine-building and Kindred Industries

RAPID AERONAUTICAL PROGRESS

Wonderful achievements, such as those of the flyers who successfully crossed the ocean, appeal to the popular imagination and receive attention possibly out of proportion to their true significance. With no intention of detracting from the credit and great public value of these achievements, we should not forget that aerial transportation has been in operation from coast to coast in this country for three years past, all our larger cities being connected by air mail routes.

The constant advance in the character of the equipment and training of the pilots is not only improving the service, but reducing the percentage of casualties. Pilots of the air mail service in day and night flying over the transcontinental route from New York to San Francisco, made the remarkable record of regularly maintaining that service last year with only one fatality for each 1,250,000 miles flown. A thousand miles of airways lighted at night have been equipped during the past year, and night flying soon will be possible on other airways besides the one from New York to San Francisco. This will facilitate the carrying of the mails and will stimulate air service for the carrying of passengers and lightweight goods.

And second to the achievements of Lindbergh and Chamberlin, and their courage and skill, stands the mechanical genius of the man or men who designed engines of such power and endurance as to make the flights possible. Back of the Hero of the Air stands the Engineer who, through knowledge, experience and mechanical skill, made the airman's feat possible.

* * *

POWER-DRIVEN CONVEYORS IN SMALLER PLANTS

Many manufacturers and engineers are under the impression that power-driven conveyors of different types are suitable only for very large plants employing many thousands of men, such as are found in the automobile and harvesting machinery industries. It is true that power-driven conveyors find their most important application in large shops, because where large quantities of material have to be carried comparatively long distances from department to department, conveyors are indispensable; but many smaller shops have recently installed conveyor systems and have found it possible to speed up production and reduce costs through their use. In several instances shops employing not more than 500 men have installed power-driven conveyors to advantage, one such plant recently visited, having increased its production over 50 per cent.

One advantage of conveyor systems, timed in accordance with the rate of speed at which the machining operations on various parts can be performed, is that a predetermined production per day can be maintained, because every operation must be performed in a given time. This principle, first applied in the assembling of automobiles, has later been applied in the manufacture and assembling of many other products, including phonographs, magnetos and small farm engines. When a bonus is paid for maintaining the predetermined production, the system permits the shop men to earn higher wages, so that both employer and employe are equally benefited by this means of increasing the output. The work of the shop men, instead of being harder, is often easier, because the lifting and handling of heavy pieces is avoided.

* * *

HAVE YOU CONSIDERED EQUIPMENT FOR SERVICE SHOPS?

It is estimated that there are about 70,000 automobile service stations in this country, of which nearly 30,000 are maintained by dealers, while over 40,000 are independent service and repair shops, generally conducted in connection with garages. The machines and tools required by these service shops is no small item, and many concerns have developed a growing business in supplying these service shops with equipment. Some of the leading automobile builders issue booklets recommending equipment for service shops, and in specifying it they take into account mainly simplicity and low cost; because the repair shop cannot afford, nor does it need, the highest quality of equipment.

Such machines and tools primarily should be easy to operate and maintain, and those most suitable for service shops should not be of a universal type, intended for all kinds of repair work, but rather should be made especially for automobile repairs. While some machine tool builders have developed equipment especially intended for this service, the manufacturers of standard machines and tools have not generally applied themselves to this market, and as a result many concerns specializing in service equipment have come into the field. These makers supply the largest proportion of the special machines and tools used.

The equipment required in a service shop depends to some extent upon the distance that it is located from automobile factories. If it is easy to obtain repair parts quickly, there are many operations that the service shop need not perform, but shops located at distant points require a more complete machine tool equipment, so that they can handle any kind of repairs and if necessary make replacement parts for emergency service. Generally speaking, the less expensive type of lathes, drilling machines and shapers are most suitable for service work, in addition to the special grinding machines that have been developed for this field. Garages that are called upon to do emergency work only, have found some of the recently developed multi-purpose machines of considerable value.

Servicing Machine Tools

Outlining the Need for a Definite Policy in the Machine Tool Industry

By a Machine Tool Service Department Manager

"PLEASE send service man immediately, wire reply." So read many telegrams received by machine tool manufacturers; and with the thought in mind that his competitor readily complies with such requests, the manufacturer dispatches a service man to the scene of trouble at the earliest possible moment.

Frequently an investigation shows that the machine requiring attention was purchased years ago. Yet there is apparently no doubt in the user's mind that he is entitled to service without charge. He feels that he paid a good price for the machine, and therefore is entitled to free service throughout its lifetime; and it is quite evident that he thinks he is entitled to service regardless of whether the machine has been disabled by a careless operator or worn out from years of use.

The cost of sending out high-grade mechanics in response to such service demands is mounting higher every year. The requests are more and more numerous. Mysterious troubles that, upon investigation, are found to be easily remedied by a simple adjustment are constantly adding to the "trouble man's" expense account. "Wire for the factory man" seems to be a popular slogan in many machine tool using plants, irrespective of the cause of the trouble or the simplicity of the difficulty.

Needless Expense Saddled on Machine Tool Builder

Recently a machine tool manufacturer was advised by wire that a machine that had been used for years did not produce accurate work. From a few words of explanation given in the telegram, the machine tool manufacturer concluded that proper leveling of the machine would correct the trouble, and advised the customer to use a sensitive machinist's level. A second telegram was received stating that this did not correct the trouble; hence, a service man was sent.

Upon making an investigation, he found that the machine was not level and that an ordinary carpenter's level had been used in an attempt to correct the difficulty. The use of a sensitive machinist's level quickly remedied the trouble, but the machine tool manufacturer was out of pocket nearly $100 for the service man's trip. This expense could have been entirely avoided if the customer had followed the manufacturer's directions.

Hundreds of such instances could be cited, and who is it that pays the bills? Under present conditions, the customer will not do so. If the slightest hint is given that the customer will be expected to stand the charges, he intimates something about diverting future business into other channels, and there you are. The machine tool manufacturer decides to shoulder the expense and "writes it off."

The automotive field probably expects more free service than any other industry, regardless of the length of time that the machine has been used. Without any apparent concern as to whether the trouble that has developed is due to a fault of the machine or to incompetent or careless operators, the user insists on having the machine tool manufacturer put everything right, and does not expect to pay for the service.

The situation has gradually grown to a stage where the free service problem is one of the greatest questions facing the machine tool manufacturer; and where there is a likelihood of the adoption of definite service charges after a machine has been used a certain period. The trouble is that each individual manufacturer dislikes to announce the inauguration of such a service charge, because he feels that his competitors will then have an advantage and will make the most of it.

Comparison with Service Rendered by Makers of Automotive Equipment

The profit on machine tools is no greater and, in most cases, much less than that on automotive products; yet, note the difference in the service offered. The machine tool manufacturer gives almost unlimited free service, while, in the automotive field, after a stipulated time you pay for anything you want done to your automobile. Does the automotive manufacturer concern himself about his competitors in this respect? Apparently not. He has had the foresight to realize that such service is an unwarranted imposition and that it is in the interest of the entire industry that every manufacturer takes a firm stand against just such demands as the industry itself makes on the machine tool builder. The automotive manufacturer has been very successful in carrying out this policy.

Rising Cost of Service in Proportion to Sales

In the last seven years no machine tool manufacturer has been overburdened with business, but the item of servicing machines has steadily mounted during the same period. Unfortunately, actual statistics are not available, but there is every reason to believe that, taking the industry as a whole, the expense of free service has increased out of all proportion to sales. This condition has been brought about by each manufacturer attempting to "out-service" his competitor. Will there be no end to this? If not, what will be the eventual outcome?

If the machine tool manufacturer, each in his place, would adopt a courageous policy in regard to the amount of free service that he will give, and make it clear that after a machine has been in use for a certain time, all service will be charged for, the conditions could be very easily changed. The machine tool manufacturer is not able to bear the

expense of free service for keeping all the machines of his manufacture in good running condition for years and years after they have left his factory. The sooner he adopts a definite policy in this respect and stands by it, the better off he will be.

A Possible Solution of the Service Problem

It is the firm belief of many in the industry that every machine tool builder, instead of offering unlimited service with the sale of each machine, whether standard or special, should set a time limit during which free service will be rendered, if necessary, and make a definite statement to that effect at the time the sale is made. If the automotive industry has been able to build up a large and successful business by the use of this policy, why should not the machine tool builder apply the same principle to his product? This question deserves the careful attention of every machine tool maker.

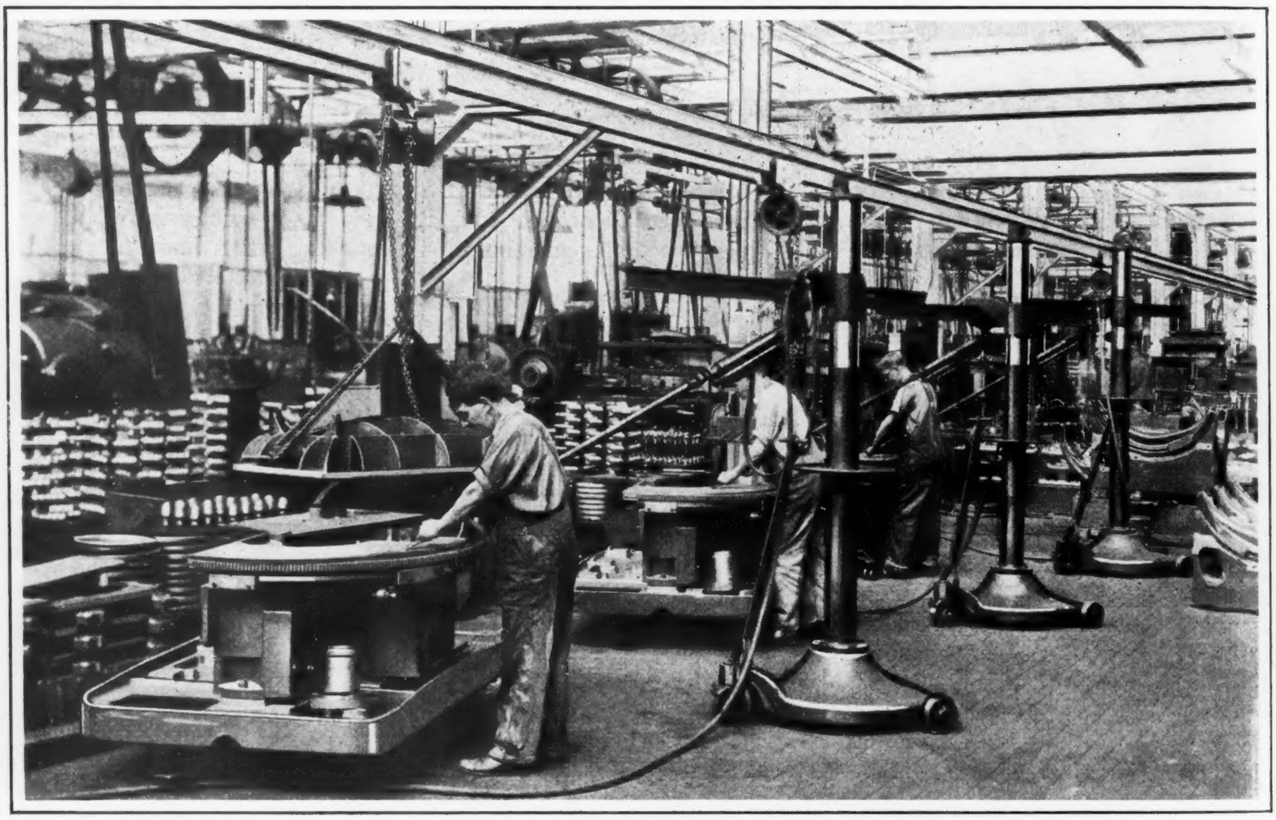
* * *

Nominations for officers of the American Society of Mechanical Engineers for 1928 were announced at a recent meeting of the nominating committee held at White Sulphur Springs, W. Va. The nominees are: for president, Alexander Dow, President, Detroit Edison Co., Detroit, Mich.; for vice-presidents: John H. Lawrence, Vice President & Engineering Manager, Thomas E. Murray, Inc., New York City; Newell Sanders, Newell Sanders Plow Co., Chattanooga, Tenn.; Edward A. Muller, President & General Manager, King Machine Tool Co., Cincinnati, Ohio; Paul Wright, Paul Wright & Co., Birmingham, Ala.; and for managers: William A. Hanley, Chief Engineer, Eli Lilly & Co., Indianapolis, Ind.; Luther B. McMillan, Chief Engineer, Johns-Manville, Inc., New York City; and Fred H. Dorner, Milwaukee, Wis.

SCRAPING MACHINE PARTS WITH PNEUMATIC EQUIPMENT

In hand-scraping the bearing surfaces of machine parts, production is often retarded by fatigue of the operator. For this reason, the scrapers employed at the Gleason Works, Rochester, N. Y., are provided with the pneumatic equipment here illustrated. Each man is assigned to a turntable, on which the work is placed for the operation. This table may be indexed to permit of conveniently "crossing" the scraping cuts. It is ordinarily locked stationary, and a foot-treadle must be depressed preparatory to indexing.

Each operator is also furnished with a portable three-wheel truck having a vertical post on which is mounted an I-beam that may be adjusted for height. Suspended from a trolley which may be pushed back and forth on this I-beam is a pneumatic scraper. The I-beam is of sufficient length to enable comparatively large surfaces to be scraped without shifting the truck.



Scraping Department in which Pneumatic Equipment and Turntables Facilitate Production

Directly above the row of turntables there is an I-beam that runs the length of the department, serving as a runway for the trolleys of hand chain hoists. Surface plates are suspended from these hoists for checking the finish of the surfaces being scraped. In order to determine the location of high spots on a scraped surface, red lead is smeared over the surface and then the surface plate is rubbed over the work in the usual manner.

* * *

The use of non-metallic material for gearing is constantly increasing. One concern making materials for this type of gears states that the output during 1926 was twice that of 1925, and the volume continues to increase during the present year in almost the same ratio.

The Welding of a Steel Structure

A GREAT deal of publicity has been given to the fact that an all-welded five-story shop building was recently erected at Sharon, Pa., for the Westinghouse Electric & Mfg. Co. by the American Bridge Co. Few definite details relating to this work were known, however, previous to the reading of a paper by James H. Edwards, assistant chief engineer of the American Bridge Co., before the American Iron and Steel Institute at a recent meeting in New York City. In this paper, Mr. Edwards mentions that as this building is probably the outstanding example up to the present time of welded building construction, a description of its design, fabrication, erection, and cost, naturally will be of interest to engineers, and he, therefore, prepared an extensive paper from which the following information has been abstracted.

The Design of the Building for Welding

The structure erected is a five-story shop, 70 feet wide, 220 feet long, with eleven 20-foot panels running longitudinally, and three transverse aisles. The building was first designed as a standard riveted type. The steel skeleton frame consisted of solid rolled columns, and the floor framing, of rolled beams, except the girders supporting the columns above the crane runway, which were riveted plate and angle girders. All floor supports were figured as simple beams or girders supported at the ends, carrying into the columns only vertical reactions.

A design was then made for a welded structure to fulfill the same purpose and conditions. The distinguishing feature of the welded design was the floor framing, where advantage was taken of fixed-end condition of beams and girders, these being figured as continuous members in flexure, with a theoretical increase in load capacity of 50 per cent. Estimates of weight of steel of the two designs indicated a weight of 885 tons for the riveted design, and 790 tons for the welded design, the saving being in the floor framing girders.

Preparations for Welding

The American Bridge Co., which erected the building, in order to satisfy itself that its welders could do the work and to establish some procedure of operation for welding the large second-floor girders, turned over to the welders some stock plate material with instructions that they try out their skill in making a similar girder. No attempt was made to select material for, or to design, a properly proportioned girder, only the welding of the joints being under consideration. This test gave assurance that if the regular welders, without any technical guidance, could produce such results as were obtained, the girders in the structure, when properly designed, could be made and depended on to perform their duty.

Aside from the difficulty in plumbing the frame and holding it in proper position by the use of wire guys, instead of many drift pins in holes, the protection of the eyes of welders by shields and helmets, and the precautions necessary to avoid fire from sparks that might fall on the welders' clothing or inflammable material nearby, no unusual precautions were taken, other than those met with on other field jobs.

Cost of Welding Compared with Cost of Riveting

Accurate cost records were kept of all operations connected with this work, particularly the welding. These are summarized as follows:

The amount of welding done in the shop, taking as a basis of measurement 100 inches of single-run 5/16-inch to 3/8-inch fillet, was approximately 244,000 lineal inches, using 11,700 pounds of 24-inch by 3/16-inch welding wire electrodes, and the cost was $4.18 per 100 lineal inches. In the field, 129,500 lineal inches were welded, using 4882 pounds of 16-inch by 5/32-inch welding wire, and the cost was about $8 per 100 lineal inches. The waste or loss of welding wire was 25 to 30 per cent, and the weight of wire consumed was about 1 per cent of the weight of the structural steel. By comparing the actual costs of this welded structure with what a riveted one might be expected to cost, we find that there was a saving in material, due to design, of about 95 tons, or 11 per cent; the templet making was a trifle less for the welded construction; the shearing, marking, punching, and finishing was about 10 per cent less for the welded construction; the assembling of parts for welding, about 100 per cent more than for the riveted construction; and the welding in the shop, not including the use of electrical equipment, showed a cost four times that of shop riveting. The raising of steel in the field, due to extra guying for alignment, was increased about 10 per cent, and the field welding cost, not including the installation and use of electrical equipment, current, and training of welders, was about the same as the riveting would cost. Prevailing shop and field labor rates were paid. Standard overhead expenses are included in the costs.

After deducting the cost of training welders and making due allowance for other items that were included in this first job and would disappear if the shop were organized for welding, the additional cost of the welded structure would be about $10 per ton, or about $8000. The material saved by the welded design was 95 tons at a cost of about $3800, showing an excess cost of $4200 over a riveted structure, not including the use and maintenance of electrical equipment, welding wire, and cost of training school, all furnished by the Westinghouse Electric & Mfg. Co.

Estimates, based on unit costs determined on this work, indicate that the continuity feature of the design as a whole cost more than the material saved, besides introducing into the design and fabrication some complicated and possibly undesirable features. Continuous or fixed-end support

members have their place in structures, but before being used to any great extent, all engineering and cost features should be carefully weighed.

Based on the experience gained from this work, it would seem that the all-welded skeleton structure is not the most economical one. It is possible that some parts of such a structure might be welded to advantage.

General Conclusions from the Experience Gained

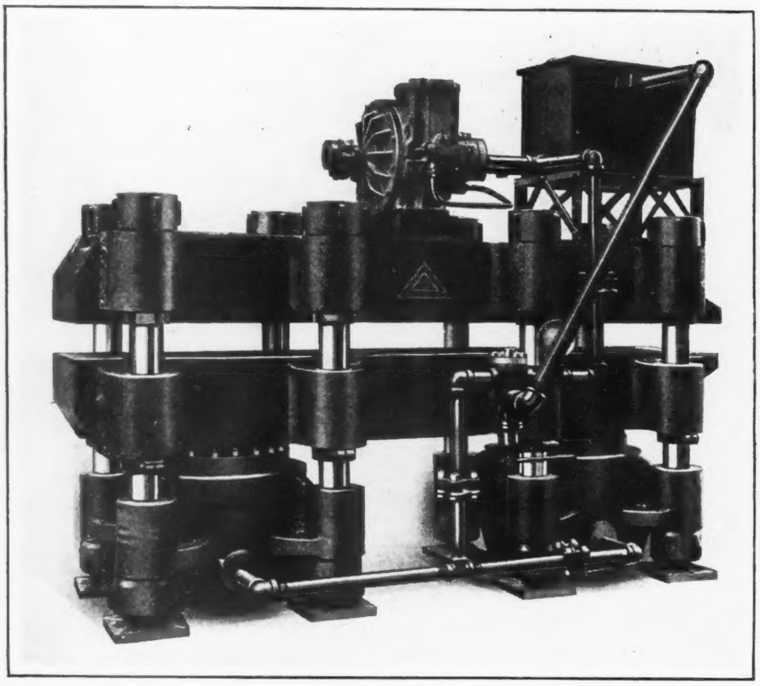
By the fusion welding process, joints can be made as strong as the base metal, and the full gross section of a tension member can be used, with no deduction for holes as when rivets are used. Owing to the greater stiffness of the end connections, and the ease with which component parts can be rigidly held together, welded details of compression members increase their efficiency. By taking advantage of these favorable factors, and with the added advantage that will obtain when sections more suited to welding are rolled, there may be some saving in material that will more than offset the extra cost of welding.

When existing structures require strengthening because of increased loading, material can be added more advantageously by welding than by the expensive method of drilling holes and driving rivets in awkward field positions; also when additions are made to structures, welded connections can be well and cheaply made with a minimum disturbance of walls and exposure of occupants. Furthermore, there are other considerations in favor of welding that might be given some weight, aside from economy, such as the elimination of noise of riveting in thickly settled communities; another somewhat connected factor is the possibility of making welded connections, for resisting lateral forces, such as wind, much simpler than the present cumbersome riveted brackets that interfere with the architectural treatment of exterior walls and interior finish. Welding can be used to supplement riveting and undoubtedly will eventually find its economical place.

Designers and fabricators of structural steel have learned from many years of experience the virtues and weaknesses of rivets, and know how to use them to make safe and economical structures. They are now seeking the fundamental facts concerning the welding art, on which they can base their determination of strength. It is generally accepted by those who have had any structural steel welding experience that safe and reliable welds can be made by a trained operator, following a well defined procedure control. There is a demand for standard specifications and methods of making welds by the different processes. Values on some unit basis for the strength of welds of different types should be fixed. Some reliable way of controlling the mechanical and personal element used in making welds, and in testing the completed work, should be established. With these factors fixed by scientific research and made available to the industry, the manufacturers of welding apparatus, the advocates of welding as a method of joining steel parts, and the fabricators of structural steel, all cooperating to solve an engineering and economic problem, will doubtless make great progress in the development of the art of welding in the structural steel industry.

* * *

A MONEY-SAVING STRAIGHTENING PRESS



Straightening Press Used for Reclaiming Nickel-iron Plates for Heat-treating Furnaces

One of the largest producers of automobiles found it necessary, at certain intervals, to replace the nickel-iron plates used in heat-treating furnaces because of the buckling of the plates. These plates are 1/2 inch thick by 20 inches wide and 10 feet 6 inches long. The material is expensive and the removed plates had only scrap value.

Recently this company installed a straightening and forming press built by the Metalwood Mfg. Co., Detroit, Mich., by means of which these plates are straightened and thereby salvaged for future use. As the material in the plates costs from 55 to 60 cents a pound, the importance of salvaging them becomes quite evident. The machine installed cost $8500, and in the first three days of its use it reclaimed a sufficient amount of the high-priced material to pay for its entire cost. This probably is the record for saving in operation costs by the installation of new equipment.

The machine has a rated working pressure of 600 tons, being hydraulically operated at a line pressure of 2000 pounds. It has two rams, each 20 inches in diameter, and is operated by a 50-horsepower motor direct-connected to a Hele-Shaw pump. The stroke of the rams is 6 inches, and the speed, 15 inches per minute. The size of the platen is 22 inches by 10 feet 6 inches, and there is a 6-inch clearance between the upper and lower platens. If necessary, this clearance can be increased within reasonable limits, the length of the stroke remaining unchanged. The clear distance between the columns is 24 inches. The height of the press is 9 feet; width, 4 feet; length, 10 1/2 feet; and total weight, 43,000 pounds.

TURNING AND FACING BELL-HOUSING CASES

The pilot and flange of bell housing cases used in Oakland automobiles are turned and faced, respectively, in the semi-automatic manufacturing lathe shown in the accompanying illustrations.

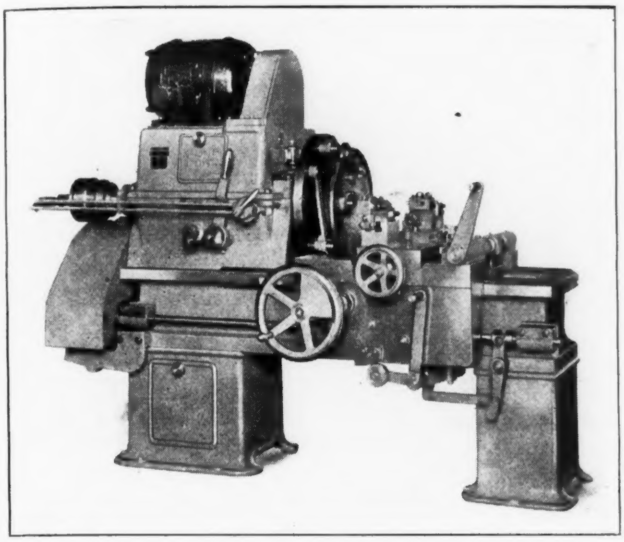


Fig. 1. Semi-automatic Operation on Bell-housing Cases for Automobiles

This machine is a recent development of the Bradford Machine Tool Co., 8th and Evans Sts., Cincinnati, Ohio. It can be adapted to a wide variety of work by making a few changes in the tooling fixtures. For the operation referred to, the work is held in a special air-operated fixture mounted on the nose of the spindle.

After the first bell housing has been secured in the air-operated fixture, the tool carriage is rapidly traversed by hand from its inoperative right-hand position, until it reaches an adjustable stop at the left. Here the carriage is secured to the bed by means of an eccentric clamping device. A control lever on the bed is then shifted from right to left, advancing both the front and rear sets of cutting tools toward the work. This is accomplished by means of a power-driven cross-feed screw, which is connected with both the front and rear tool-slides on the bridge of the carriage. When all the tools have come to the end of their respective cuts, the automatic power feed is "cut out" to permit the operator to feed the tools slightly by hand to a positive diameter stop. This helps to maintain accuracy and duplicate the size on all bell housings.

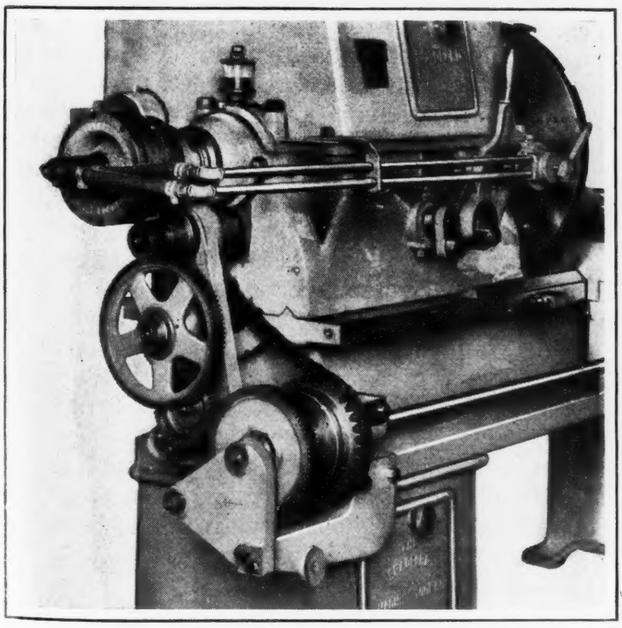


Fig. 2. Arrangement of Air Cylinder and Feed and Rapid-return Gearing

When the operation has thus been completed, the carriage clamping device is disengaged and the control lever is shifted to the right-hand or automatic quick-return position. This causes both the front and rear cutting tools to be withdrawn from the work, and the tool carriage to be quickly returned to its inoperative position about 6 inches to the right. When this position is reached, the quick return is automatically disengaged. Room is thus provided for the convenient removal of the finished bell housing and for mounting an unfinished housing in a similar manner. The operating cycle as outlined can be continued indefinitely.

Power is applied to the spindle by moving the lever seen on the front of the headstock in Fig. 2 into its left-hand position. When this lever is pushed into its right-hand position, a brake is applied to quickly stop the spindle. The arrangement of the feed and rapid-return gearing may be seen in this illustration, as well as the air cylinder for the work-holding fixture.

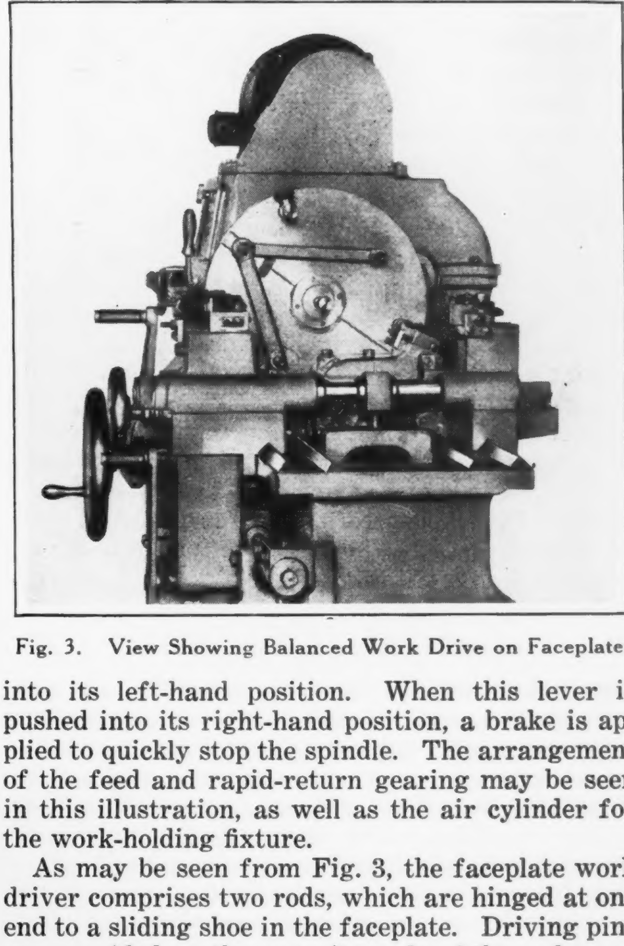


Fig. 3. View Showing Balanced Work Drive on Faceplate

As may be seen from Fig. 3, the faceplate work driver comprises two rods, which are hinged at one end to a sliding shoe in the faceplate. Driving pins are provided on the opposite ends of the rods, and these pins are loosely guided in slots in the faceplate. The driving pin at the end of the heavier link pushes against a lug on the bell housing, while the second driving pin at the end of the lighter link pulls against a second lug on the bell housing. The single sliding shoe at the hinged ends of the links serves to equalize the push and pull strains against the two lugs on the bell housing, thus resulting in a balanced drive for the work.

* * *

A new local section or chapter of the American Society for Steel Treating has been organized in the Canton-Massillon district of Ohio.

Notes and Comment on Engineering Topics

In the early period of the oil business, oil wells varied in depth from 800 to 1800 feet. A 2000-foot well was considered unusually deep. Today, wells 2000 feet deep are considered shallow, and many wells now are 5000 feet in depth. This increase in the depth of oil wells requires larger and heavier equipment for drilling, heavier materials used in the well, heavier pumping equipment, longer and heavier pumping rods, and greater power capacity for oil-well purposes. Gas engines are stated by Pat Shouvlin, in a paper presented before the American Petroleum Institute, to be the most economical and efficient for use for oil-well drilling and operation. In most cases, gas is so plentiful at the oil fields that it is allowed to go to waste, and hence, the only expense for gas engine operation is the cost of maintenance, lubricating oil, depreciation, and labor.

It is unusual for a railroad car to run 300,000 miles on one set of journal bearings. This, however, is the record to date of a twelve-wheel passenger car on the Chicago, Milwaukee and St. Paul Railroad which uses Hyatt roller bearings on all the axles. It is anticipated that this car will run 600,000 miles before the bearings need to be replaced, which is about ten times the average life of plain bearings in this kind of service. The car makes a round trip every nine days between Chicago and the Pacific Coast. The ever-increasing application of roller bearings on steam and electric railway cars is noteworthy. A ten-car subway train will soon be placed in operation equipped entirely with roller bearings. The low starting torque is of particular value in railroad service, the torque being estimated to be about one-half of what it is when plain bearings are used. The lubrication problem is also simplified. A great increase in the use of anti-friction bearings in railroad operation is looked forward to within the next few years.

The mapping of inaccessible parts of the country by aerial photography is one of the most useful forms of commercial aviation. This branch of aviation is on the threshold of a tremendous development. Aircraft is already being used extensively in mapping and surveying. A navy expedition last summer charted 40,000 square miles of territory in Alaska. The trip was accomplished without accidents of any kind, although the planes were in the air a total of 385 hours, flying about 35,000 miles and taking thousands of photographs of the topography of a mountainous country, large areas of which have been an unexplored wilderness in the past, almost inaccessible by land travel.

Another interesting use of the airplane is for crop protection by air dusting with insecticides. This offers a tremendous opportunity for fighting destructive insects in an effective way. Aircraft is also being used extensively for forest patrols to prevent fire losses.

The solution of a problem that long has vexed electrical engineers now seems at hand. According to reports from Stockholm, an apparatus has been constructed which automatically receives telephone messages in the absence of the subscriber and later can be made to reproduce them. As inventors of the apparatus are mentioned Karl Vogel and J. G. Larsson.

The apparatus is described as being of the size of a sewing machine. A simple manipulation connects it with or disconnects it from the telephone. When connected, it will answer an incoming call by a signal and record any message given. Each record contains space for forty ordinary calls. When the subscriber returns home, he simply sets the instrument for reproduction, and the recorded messages are delivered in a clear voice.

The records are said to be made in the form of a disk, and a simple operation exchanges a used record for a new one. They are inexpensive and so light that they may be sent by mail for confirmation.

How rubber articles are produced electrically by a method like metal plating was described recently at a meeting of the Detroit section of the Society of Automotive Engineers by the inventor of the process, Dr. S. E. Sheppard, of the Eastman Kodak Co. The commercial advantages of the process and the superiority of the products made by it were told at the same meeting by J. W. Schade, director of laboratories of the B. F. Goodrich Co.

The process consists in passing an electric current through a mixture of rubber latex, or uncoagulated milk of the rubber tree, with water, sulphur, fillers, accelerators, softeners, and other materials, according to the various requirements of the articles to be produced. The particles of rubber and other materials become charged electrically and are deposited together on molds of the desired shape, the same as copper or nickel is deposited on metal articles when plating. When the mixture of rubber and other ingredients is electrodeposited, the composition remains substantially unchanged during the coating, and the resulting rubber is of the same composition as the solution. This is essential to the success of the process, because the rubber compound produced must be similar to rubber produced by the mechanical masceration and compounding method. Rubber is much easier to deposit than nickel, for with the same amount of electric current a coating 1400 times as thick as nickel-plating can be deposited.

Rubber produced by the process has greater strength, toughness, and resistance to deterioration with age than rubber made in the usual ways, according to Mr. Schade. It can be made at lower cost, because lighter and cheaper machinery can be used, less floor space is needed, less manual labor is required, and automatic control of the process will dispense with the need of much skilled labor.

Dies for Producing Laminations

By P. J. EDMONDS
Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

Second of Two Articles Dealing with the Design, Construction, and Application of Dies for Manufacturing Laminations Used in Electrical Apparatus

IN the first of these articles, which was published in June MACHINERY, descriptions were given of various simple and compound dies used in the production of laminations for electrical equipment. This article will describe the details of construction of a compound die for pole laminations, an inverted compound die, several types of blanking dies, a progressive die, and a piercing die for rotor laminations.

Compound Die for Pole Laminations

The compound die illustrated in Fig. 7 is constructed for blanking material from 0.0625 to 0.0981 inch thick. The working members of both the moving and stationary parts of this die are hardened. The moving part is of composite construction, while the stationary part is made from a single piece of tool steel. In this type of die, there is a clearance ranging from 0.004 to 0.006 inch on the diameter between both parts. As a result of this clearance, a slightly burred edge is produced on the lamination, which, while not desirable, is permissible. It is necessary to sharpen both parts of this die after the shearing edges have become dull.

The lower shoe 1 is machined suitably for guide pins 18 and punch 8, the latter also acting as a die for punches 15 to 17, which are held in the upper shoe. The combination punch and die part 8 is held in the shoe by cap-screws. Bottom stripper 7 is supported by coil springs and held to the shoe by special stripper bolts.

Shoe 3 of the upper die unit is recessed to admit the assembly of die pieces 9 to 14, which are held

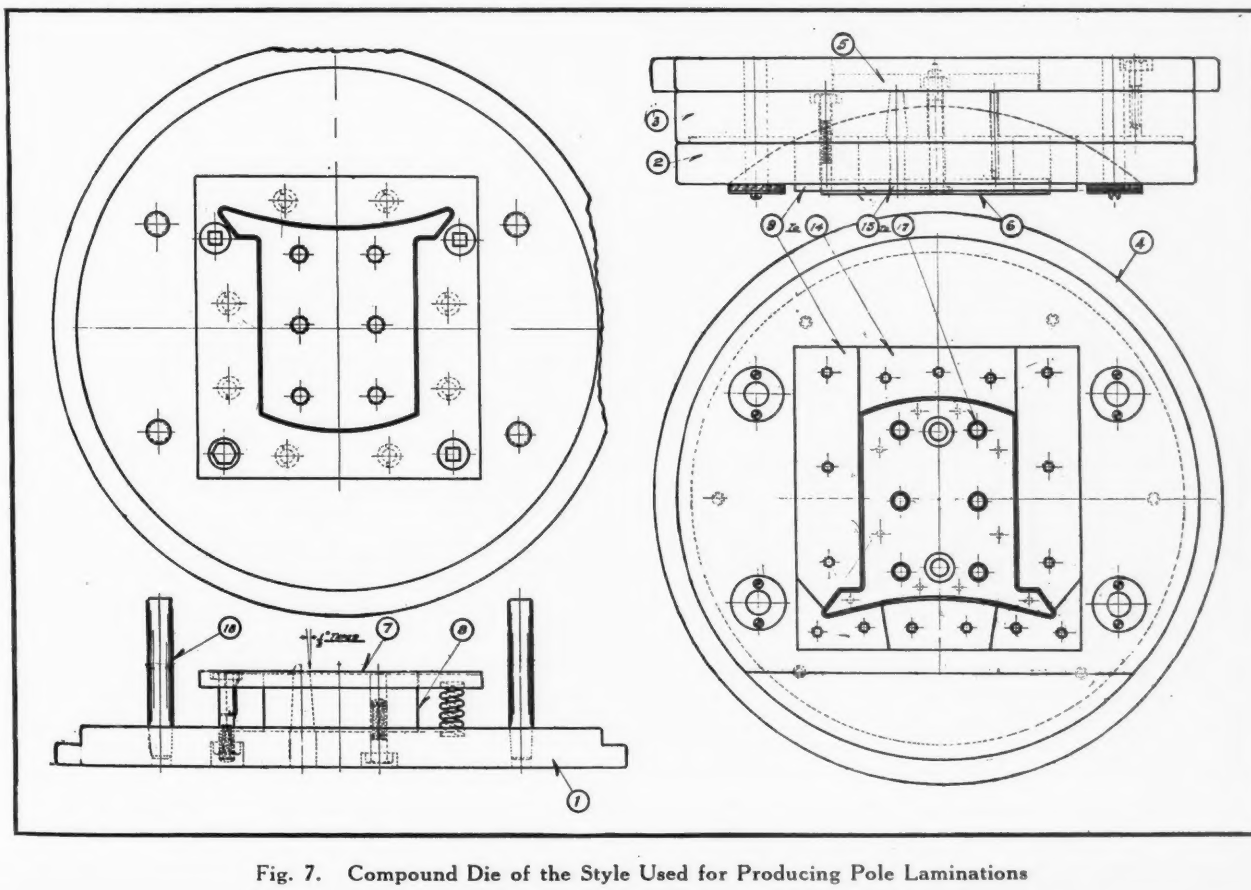


Fig. 7. Compound Die of the Style Used for Producing Pole Laminations

in position by means of cap-screws. Punches 15 to 17 are held in tapered holes in the shoe. Shrink ring 2 is fastened to the shoe by cap-screws and is provided with wiping pads for the liner pins. This ring holds die pieces 9 to 14 firmly together. Top shoe 4 is fastened to shoe 3 by cap-screws. It is cut out to permit the top knocker attachment to come in contact with knocker plate 5. Through the action of the knocker pins against the top stripper plate 6, which is held in position by stripper screws, the pole lamination is stripped from the upper unit of the die.

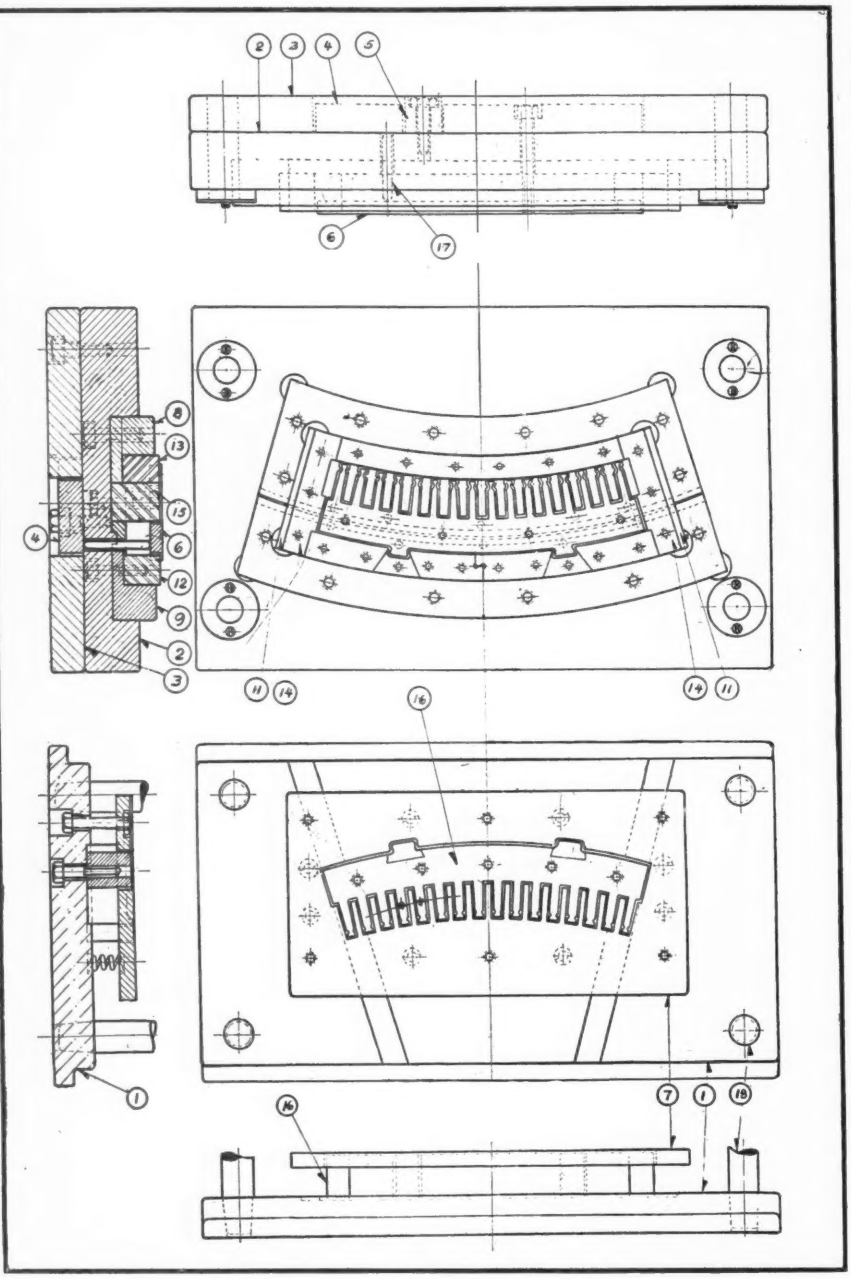


Fig. 8. Construction of a "Complete" Segmental Blanking Die

Distinctive Features of Inverted Compound Dies

An inverted compound die is a die in which the moving unit carries the male part for piercing the outside of a lamination, and the female part for cutting screw or rivet holes. The female part is held stationary for cutting the outside of the lamination, and the male part for piercing screw or rivet holes. In general, inverted-type designs follow closely those of other compound dies. The major difference is that the moving part of the ordinary compound die is the stationary part of the inverted die, and the stationary part of the ordinary type is the moving part of the inverted die.

Slugs from the piercing punches move upward through the moving part of an inverted die, passing through channels to one or both sides of the shoe, from which they escape. Ejection of the lamination from the stationary part is accomplished by means of an inside stripper actuated by springs. The scrap is forced from the moving part by an outside stripper, which is operated by springs or a knocker attachment in the ram.

Dies of this type are intended for small detail laminations, and hence there is no necessity for composite construction. While extreme accuracy of dimensions is required, this can usually be attained by making the major parts of the upper and lower units from single pieces of steel. The part attached to the upper or moving shoe is not hardened. There is little clearance between the upper and lower die parts, and the product is practically burrless. The die is kept in an operating condition in much the same manner as those described in the previous article.

Inverted compound dies are used for blanking laminations of irregular shapes, magnets, cut-out switches, and transformers. They produce a lamination complete at one stroke of the press, and are employed when the lamination cannot be picked from the strip of material simultaneously with the advance of the material for the next operation. During the process of blanking laminations, the stripper on the stationary part of the die pushes the blanked lamination back into the strip of material. Then, when the material is advanced by hand the proper distance, the lamination drops from the material on a pile in front of the die.

Blanking Die of Simple Design

In a blanking die, the punch or male part is usually the moving member, and the female part the stationary member. Three types of blanking dies are designed by the Westinghouse Electric & Mfg. Co. for segmental laminations. Of these, type A is constructed to produce a lamination complete in one operation, and is termed a "complete" blanking die. It is designed to meet large production requirements. Type B is called a "partial" blanking die. All dimensions are fixed, except the width of the lamination and the size and shape of the winding slots. Locating pins are set at suitable distances on the bottom plate to limit the width of the segment.

A subsequent operation, which consists of trimming and slotting the teeth simultaneously, is performed in an automatic slotting press to finish the lamination. This type of die may be used for producing laminations of various widths, containing different winding slots, when production requirements are small.

The type C die is called a "closed" blanking die. All of its dimensions are fixed, except those relating to the shape and number of coil slots. A subsequent operation, also performed in an automatic slotting press, is necessary to complete laminations produced in this type of die.

Construction of a "Complete" Segmental Blanking Die

A type A segmental blanking die is shown in Fig. 8. The lower part has a shoe 1 which is machined to fit the tool-steel punch 16 and two pieces dovetailed to the punch, all three of these parts being fastened to the shoe by cap-screws. The punch is not hardened. It is recessed about 3/8 inch deep, a shearing edge about 1/16 inch wide extending around the perimeter. From this edge the metal tapers 45 degrees to the bottom of the recess. Stripper 7 is supported by coil springs, and held in position by special stripper screws. Liner pins 18 are fastened in the corners of the shoe.

The upper unit contains shoe 2, which is machined to admit die-piece holders 8 and 9. These holders support tool-steel die members 12, 13, and 14, and filler pieces 11. The tooth die pieces 15 are fitted into slots in holder 8 and held securely by calking. Pieces 8, 9, 12, 13, and 14 are held in position by cap-screws. Top plate 3 is fastened to shoe 2 by means of screws. The top stripping device includes top knocker 4, knock-out pins 17, distance block 5, and inside stripper 6.

Both "partial" and "closed" blanking dies so closely follow the design of "complete" blanking dies that it is not considered necessary to illustrate them in these articles.

Characteristics of a Progressive Die

A progressive die is termed a "simple" die, as it consists of a series of simple dies arranged on one shoe for performing operations in sequence at the different stations of the die. It is constructed to meet the demands of intensive production. Progressive dies are used for blanking rotor and stator laminations, both at different stations of the same strip and separately. E-plates and pole laminations are also produced in dies of this class.

Progressive dies for blanking laminations are used on presses equipped with an automatic feed; when constructed to meet the requirements of presses equipped with a roller feed, they are sometimes termed "roller-feed" dies. These dies are seldom used, however, when the feeding distance is greater than 6 or 7 inches. When the distance exceeds this amount, the number of press strokes per minute must be reduced, and so economies may be effected through the use of other types of compound dies.

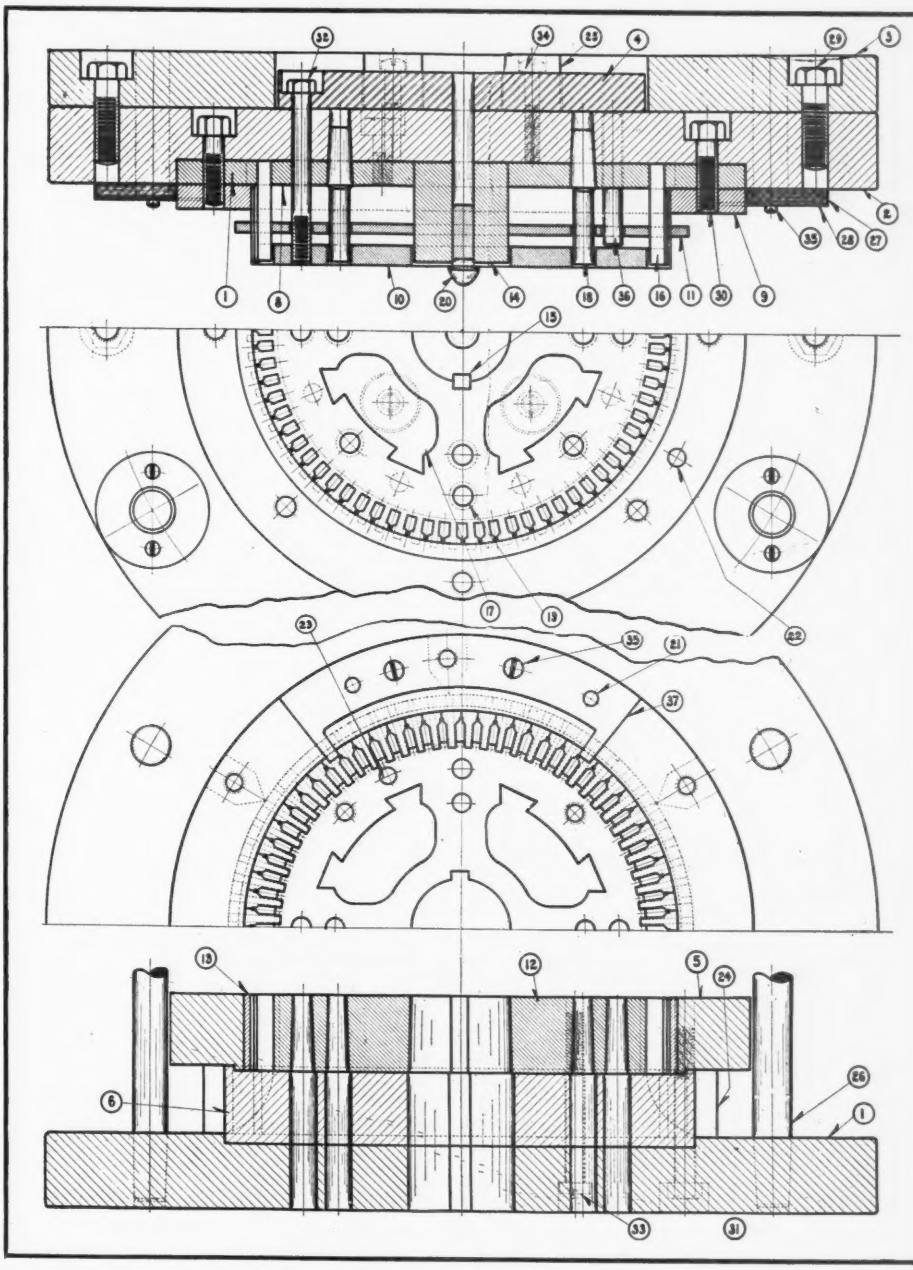


Fig. 9. Piercing Die Designed for Blanking a Rotor Lamination from a Disk Cut Out of the Center of a Stator Lamination

Fig. 10 shows the different stages in blanking rotor and stator laminations with a five-step progressive die in one operation. The first or starting step consists of piercing the winding slots, bore, and keyway in the rotor, as shown at the extreme left. In the second step, the winding slots and rivet holes of the stator are pierced; in the third step,

the rotor is pierced from the strip; in the fourth step, the inside of the stator is trimmed; and in the fifth step, the stator is blanked from the strip. Both the rotor and stator laminations pass through the die at their respective stations into suitable packing devices, and may be removed by the operator while the machine is in operation.

Both the male and female parts of the die used in this operation are hardened. The female part is usually made from a single piece of tool steel, while the male part is of composite construction.

Piercing Die for Rotor Laminations

The piercing die shown in Fig. 9 is designed to produce a rotor lamination from a disk cut from the center of a stator lamination. It will be obvious that economy of material is attained by this practice. The general design of the die follows closely the design of the compound die for rotor laminations, which was shown in Fig. 5 of the first article. In designing this die, provision had to be made for disposing of the slugs obtained in perforating the coil slots. These slugs pass through holes in sections 13 and out of openings in raising plate 6. The rotor lamination produced from this die is of the closed-slot design, which makes composite construction of parts 5, 12, and 13 the most economical.

Shoe 1 is drilled and reamed to hold liner pins 26, and is drilled and counterbored to receive raising plate 6. Die part 12 is fitted into the counterbore of the raising plate, and the sectional die pieces 13 are fitted into slotted sections of part 12. These die pieces are held in position by shrink ring 5, which is supported by blocking pieces 24 and held to the shoe by screws 31 and 33 and dowel-pin 23. Gage 37, which provides a means of locating the disk approximately, is fastened by means of screws 35 and dowel-pins 21. Die parts 5, 12, and 13 are not hardened. The die is under-cut, 1/16 inch of flat surface being left around all cutting edges, as on the dies previously described.

The upper unit of the die has a shoe 2, which is drilled and tapped for cap-screws 29 and 34; drilled and counterbored for screws 30; drilled for screws 32, and knock-out pins 36; recessed to admit punch-holder plates 1 and 8; drilled and taper-reamed to receive punches 18; and drilled above center pin 20. Plate 9 is held in position by screws 30, which also hold punch-holder plates 1 and 8. The tooth punches 16 are assembled in punch-holder plates 1 and 8, and ventilating punches 17 also fit in plate 8.

Punches 18 for bolt holes are held in tapered holes in plate 8 and shoe 2. Distance plate 11 supports punches 16 and 17, bore punch 14, and keyway punch 15. Center pin 20 accurately locates the blank. Top plate 3 is fastened to shoe 2 by means of screws 29. Both the shoe and top plate are drilled and reamed for liner pins 26 of the lower unit. Shoe 2 is also drilled and tapped to permit the assembly of felt washers 27 and steel washers 28 by means of screws 35.

The top knock-out comprises stripper 10, knocker plate 4, and pins 36. This unit is held together by bolts 32 which pass through holes in plate 4, shoe 2, plates 8 and 11, and are screwed into stripper plate 10. Distance blocks 25 support ventilating-hole punches 17, and are fastened by screws 34. The sectional tool-steel parts that are hardened before assembly include parts 14, 15, 16, 17, and 18.

* * *

LUBRICATION OF WIRE ROPE

Practically all the cores of good brands of wire rope are thoroughly impregnated with a commercial, chemically neutral rope oil. While the core retains a liberal supply of this lubricant, the American Cable Co. advises frequent application of a good lubricant during service, to prevent the core from becoming dry. A dry core will both wear and crush quicker than an oil-impregnated core. Furthermore, it will absorb moisture, with the result that the core will deteriorate rapidly and the inner wires will corrode, thus shortening the rope service.

The smaller the sheaves or the heavier the tension on the rope, the more often should the rope be lubricated. A good lubricant retards corrosion of the wires and deterioration of the core, reduces internal friction which is the cause of wires breaking from bending stresses, and decreases external wear. The lubricant should be thin enough to penetrate the strands and the core, but not so thin as to run off the rope, nor so thick that it merely covers the rope. Therefore, semi-plastic compound applied hot (in a thinned condition) is the best wherever possible. It will penetrate while hot, then cool to a plastic filler, excluding the entrance of water, and both preserving and lubricating the inner wires and cores.

To lubricate properly with a heated lubricant, it is necessary to have the rope run slowly through a tank of heated oil. This is the best possible method to allow penetration. When this is not possible, an application of a thinner and unheated lubricant will give better results. It is always well to lubricate rope just after installation and before running in service, particularly when it has been kept in storage for any length of time.

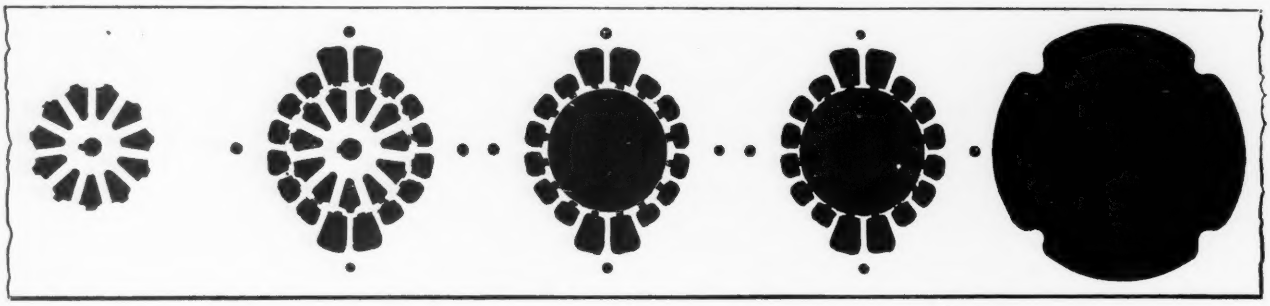


Fig. 10. Sequence of Steps Performed by a Progressive Die in Blanking Rotor and Stator Laminations

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

A FOREMAN'S JOB

There are many foremen who have never made a complete analysis of what actually is their job. They think they know what is required of them, but if you ask them to sit down and tell, in detail, exactly what they are supposed to do, many have difficulty in telling, even in a general way, what they are expected to handle.

Old Man Ross didn't have a great deal of education—he even had difficulty in writing his own name—but he was a real superintendent. He was in charge of a factory doing general repair and maintenance work on heavy machinery. One day he hired a young man who was a good mechanic and had a fair education, and called him assistant superintendent, giving him also such authority as would go with that title. One day Ross came through the shop and found his assistant with his coat off working at a job while the men stood around watching him perform. He touched him on the shoulder and said, "When you get through, come into the office, I want to have a talk with you."

When he came to the office, the young assistant "super" was surprised at being asked, "I am just wondering what I am paying you for? Do you know?"

After due consideration, the young man answered, "For seeing that the work goes through this shop as cheaply as possible."

"That's it," said Ross. "I pay you for seeing that the work is done, but not for doing it yourself, and the next time I see you with your coat off and the men watching you work, you and I part company."

From that moment on the young assistant superintendent had a better understanding of what was really expected of him—something that he should have been able to think out for himself without an object lesson.

Every foreman in a factory should be asked to write down his own conception of the job he is handling. These reports should be looked over by the superintendent or manager, and if any man appears to have a hazy conception of what his duties are, they should be clearly defined to him so that he understands his responsibilities.

J. S. G.

SHOP CONTACTS FOR THE DRAFTSMAN

There is one important phase in the development of a draftsman that is often overlooked or not properly emphasized, and that is the shop or field contact. To permit a new man to go on month after month designing machines or structures without ever coming into contact with his designs while under way, is not only retarding the draftsman's own development, but may often indirectly increase the firm's cost in an alarming way. Yet this condition prevails in many instances throughout the industrial field.

If the manufacturing operations are carried on at the same plant where the engineering work is done, the easiest method of educating the draftsman to be "shop wise" is to permit him to go into the shop whenever a question arises concerning a drawing he has made. In this way, he comes into direct contact with the shop point of view, and after thoroughly reviewing the question, he can report back to his superior for any decision affecting a change in design. If the manufacturing, erection, or construction work is done at some other site in the vicinity, inspection trips should occasionally be permitted, even though they carry with them no authority for action, but are made purely for observation purposes. There is hardly a draftsman whose work is so good that, when he sees a job in "actuality," he cannot get an idea or two for improving it the next time. These ideas he would never get, if he continued to see the work only on paper.

Any industrial executive can cite instances where a certain method of construction or type of design has been used for years, until some designer looking at the actual product has exclaimed, "There must be a cheaper way to do that." Since the ultimate success of many products in this specialized age is directly proportional to costs, it is imperative that proper consideration be given to costs at their very inception—in the drafting-room. Shop contacts are believed to be one of the means that can be used to obtain a lower ultimate cost.

JOHN F. HARDECKER

THE VALUE OF UP-TO-DATE EQUIPMENT

Efficient tools are the foundation of both quality and quantity production. Probably more waste in shops is due to the use of antiquated or unsuitable equipment than to any other cause. One firm that was unable to meet the competition of others in the field asked an outside engineer to look into the cause of the difficulty, and to determine why its production costs appeared to be higher than those of its competitors.

The man went into the shop suspecting that, to a certain extent, the machines themselves were to blame for the great waste of materials that was in evidence. The reports of the inspection department indicated that there was an exceptionally high rate of scrap in the product coming from certain machines, and it soon became evident that the machines were at fault.

In one case, the bearings of a machine were so worn and the spindles so loose that it was impossible to obtain a perfect piece of work. The machine was apparently satisfactory for work that

did not have to be within close limits, but for accurate work it was useless. Six men had been discharged by the foreman as lacking in skill and ability, before it was understood that it was the old dilapidated machine that was at fault rather than the men.

In some plants, new developments are carefully studied, and whether new equipment is bought or not, the shop management is always fully informed on the features of modern machines. In one case, the superintendent has an assistant who carefully goes over all machine tool advertising and descriptions of new machinery and tools, and compares the performance of the new machines with what is already being accomplished in the shop. Where definite savings can be proved by the use of new equipment, it is usually bought.

In another plant of fairly large size, one of the men in charge of production gives his entire time to obtaining information about new machines, tools, and methods. He collates all the facts and makes comparisons between present and proposed machines and methods to show whether or not it is good economy to buy a new machine.

The waste due to the continued use of old, weak, or worn out machines is being more and more recognized. Many manufacturers are finding out that to compete successfully they must spend money on new equipment rather than institute doubtful economies by holding down the investment in new machinery. RUSSELL J. WALDO

LEGAL FEES VERSUS MACHINIST'S CHARGES

To the machine shop owner who is used to charging from a dollar to a dollar and a half an hour for the labor of a skilled man, including the use of several machine tools and a great number of other tools and devices necessary for doing contract or jobbing work, the charges made by some professional men for a few minutes time spent, say, in writing out a prescription or in filling out the lines of a legal paper seem little short of extortion.

Legal fees, in particular, and the useless red tape of the law—all at a lawful rate per yard—are particularly discouraging to men with a lifetime's training in direct methods, who are in constant search of means for achieving results economically. From a general knowledge and often from bitter experience, the small machine shop owner keeps as far away from the "law" as possible, even to the point of overlooking matters in which a lawyer would really be of assistance in the business.

Recently the writer had occasion to take note of the winding up of the affairs of a small machine shop in a Pennsylvania town. The owner had a fair equipment for a small machine shop and had struggled hard to protect his $3000 investment, giving his community the benefits of honest work in a productive trade; but he failed, and a receiver was appointed to wind up his affairs. The unsecured creditors received nothing, because nothing was left after the receiver's charges were satisfied. The receiver's sale of the equipment brought only a small return, the buyers present being a junk man and a couple of blacksmiths. The referee's fees, the fees of two appraisers, the assessor's fees, and the court charges totalled $354—all of this for a little shop that any man familiar with the cost of machine tools could have appraised and listed at its present worth in two hours.

In another case, a man acting as receiver for a firm changed a losing business into a prosperous one. He could have turned a solvent business right over to the stockholders, having satisfied all the creditors and put modern machinery into the plant. He had done a creditable job as an engineer, but this was too simple a way of handling the matter. Two years of legal machinery had to be put into action by the courts, and after those two years, the plant was turned back to the owners in a condition where its value as a going concern was not more than ten cents on the dollar.

What can the small machine shop owner do about it? The first thought may be—keep away from courts and lawyers if possible. A better plan, though slow, would be for men in the engineering field, and in business generally, to wake up and demand a simplification of legal machinery and the speeding up of court proceedings. Here we are, as engineers and manufacturers, exerting ourselves to save half a cent in production costs per piece, and yet we sit quietly by and see this great non-productive national waste go on without a word of protest.

This is a matter that really concerns machine shop owners and engineers as much as any mechanical problem, because after all, we are concerned with mechanical problems simply because we expect them to produce a profit for us. Anything mechanical or non-mechanical that takes this profit away from us closely concerns us.

What we are particularly concerned with are the charges made for machine shop work. There are thousands of small shops scattered over the country in which the wage scale is lower than for any other work in the same locality; and the hourly charge for work in the shop is less than that made in any other trade. The charges cannot be compared with the so-called professional charges, which are often backed by much less investment and very little if any more preparatory time than a competent man spends in an apprenticeship and in learning his trade and acquiring an engineering education.

Rates for jobbing work are ridiculously low. There are cases where they would be perfectly fair if they were doubled, and the trade would be accorded more respect as well. Those engaged in it would also be enabled to set aside enough money to replace their machines—something they must ultimately do if they are to remain in business. The reason that so many small machine shops fail is because there is no reserve set aside for maintaining efficient equipment.

DONALD A. HAMPSON

* * *

According to information issued by the Amtorg Trading Corporation, 165 Broadway, New York City—the principal organization in the American-Soviet trade—this corporation has during the last three years bought about $65,000,000 worth of goods for export from the United States to the Soviet Union, including industrial machinery valued at nearly $17,000,000.

Design and Construction of Taps

With Special Reference to Taps Having Ground Threads—Fourth of a Series of Articles

By A. L. VALENTINE, Manager, Tap and Gage Division, S K F Industries, Gothenburg, Sweden

In the installments of this article previously published, the inaccuracies frequently found in taps that are not ground in the thread after hardening have been discussed, and the reasons for the development of ground taps, tolerances, and forms of flutes have been dealt with. The present article will take up the effect of different forms of cutting edges, relief of the threads in taps, over-size dimensions on the diameters of taps, root diameters, back taper, and different types of taps generally ground in the thread.

Effect of Different Forms of Cutting Edges

The effect of different forms of cutting edges on taps is illustrated in Fig. 1, where, for the sake of clearness, the cutting edges are shown compared with the cutting edges of ordinary cutting-off tools and threading dies. Practice has proved that, in steel, a cutting-off tool as shown at *A* does not cut right, the one shown at *B* cuts better, and the one shown by dotted lines at *C* cuts steel best and most freely of all.

It is true that a tap, as compared with a cutting-off tool, has an entirely different cutting problem, especially as the feed of the tap and the consequent chip thickness is entirely controlled by the lead, the number of flutes, and the length of the chamfer; nevertheless, experiments and tests have proved that a tap fluted as shown at *D* does not cut right in steel, while one fluted as at *E*, with a straight cutting face, cuts better, and one fluted as at *F* with a curved cutting face, cuts still better. Hence, the same relative results are obtained with taps as with cutting-off tools, and the same is the case with threading dies, as shown at *G* and *H*, the one shown at *G* having straight cutting edges, while the one at *H* has a convex cutting edge.

Tests have also shown that a tap with a straight cutting face, as shown at *E*, cuts more easily than one with a curved cutting edge, as indicated by the dotted line in the same illustration. The reason for this is undoubtedly that the cutting edge, when curved, has a negative rake near the bottom of the thread. The experiments also proved that a tap with a straight cutting face, as shown at *F*, is not practical, because the positive cutting angle is too great and the section of the lands too weak. The cutting profile shown by the dotted lines at *F* proved superior to all the others.

With the latter cutting profile, a constantly decreasing positive rake is obtained for the whole thread depth, the lands of the tap retain their strength, the chips curl and are cut off with a minimum amount of power, and the cutting edges are sufficiently strong and have enough body to withstand the duty imposed upon them.

Relief of Ground Taps

When spiral flutes are used, the relief of the threads can be made very much smaller than would be necessary for a tap with straight flutes in order to have it cut with the same ease. Straight-fluted taps, however, are generally relieved but little, if any, due to the fact that with even a very small amount of relief they do not cut a round hole or a smooth thread. It is probable, therefore, that apart from the spiral form of the flutes, the spiral-fluted ground taps cut freer and easier than straight-fluted ones, because they can be properly relieved. The reason for this is that the cutting teeth on a spiral-fluted tap support and steady it on the greater part of its circumference, whereas a relieved straight-fluted tap is supported on as many straight lines or edges as the tap has flutes.

A makeshift relieved straight-fluted tap was made many years ago in the construction of the "con-eccentric" tap for the reduction, to some extent at least, of the friction between the tap and the hole while tapping. This type of tap is shown in Fig. 2, from which it can be seen that two-thirds of the lands are relieved, while the remaining one-third, near the cutting edge, where the relief really is chiefly needed, has no relief at all.

Amount of Relief on Spiral Fluted Ground Taps

The amount of relief on taps depends mainly on the type of the tap, the material to be tapped, and the manner in which the tap is to be used or held.

The author believes that the relief on ground taps for general use should be practically constant at any point behind the cutting edge; 0.0005 inch for each 1/16 inch behind the cutting edge is to be recommended. As the width of the land is larger on taps of larger diameter with the same number of flutes, the total amount of the relief, that is, the difference in diameter across the cutting edges and across the heels of the lands, naturally becomes greater on larger taps.

Chamfer on Taps

The diameter at the point of the tap should be equal to the root diameter. The angle of the chamfer should be 3 degrees, 7 1/4 degrees, and 23 1/4 degrees, respectively, for taper, plug, and bottoming hand taps. These angles represent the general practice in continental Europe, England, and Scandinavia. A comparison will show that the chamfered lengths are greater than are generally used on hand taps of American manufacture, and the same relation also holds true in the case of machine or nut taps.

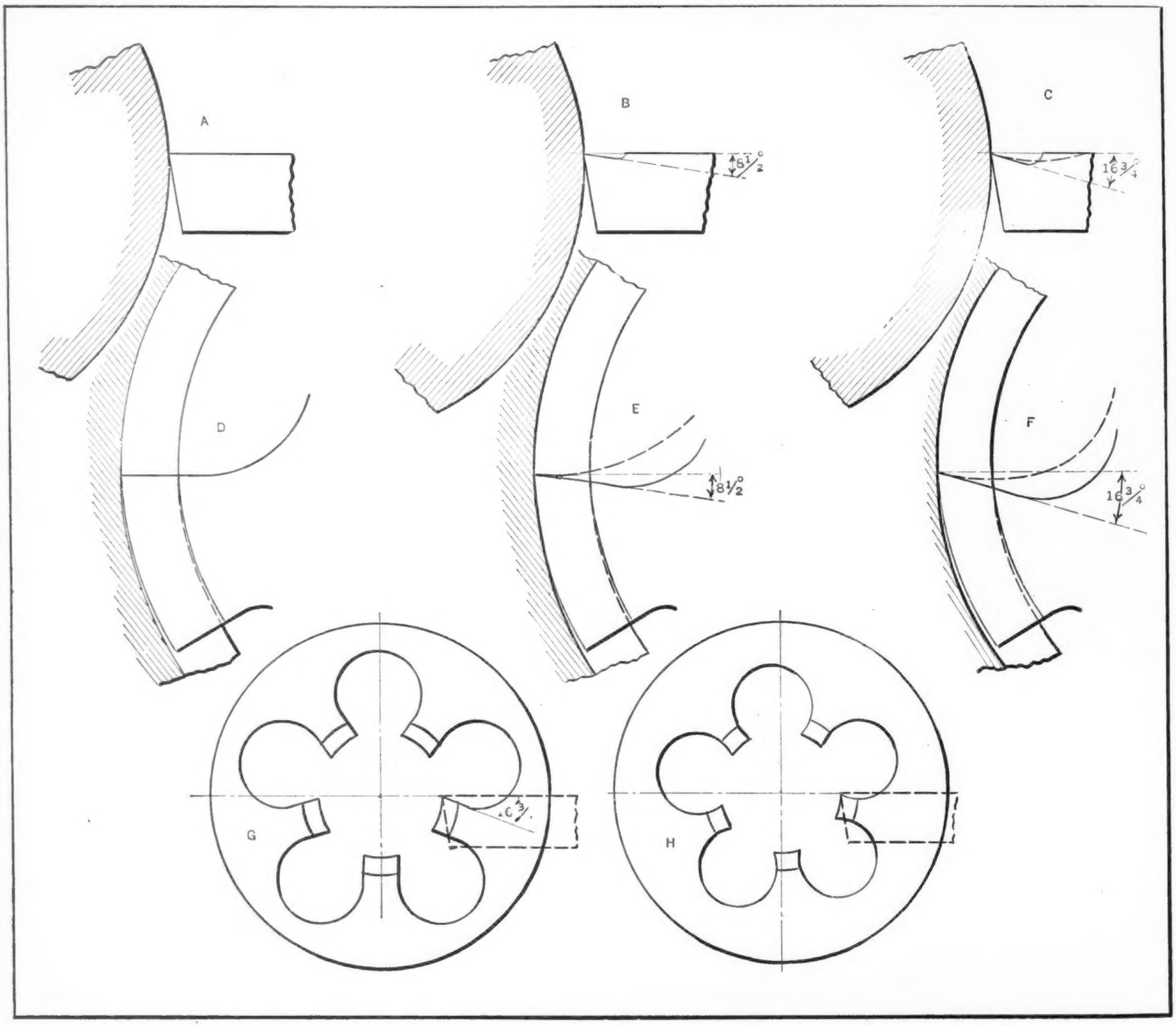


Fig. 1. Comparison between Different Cutting Edges on Cutting-off Tools, Taps, and Dies

It is stated that this longer length of chamfer was adopted in Europe in order to claim an advantage over taps manufactured in the United States, which for many years have been recognized as the best tools for thread cutting. In the writer's opinion the longer length of chamfer is to be recommended, as most taps are used for through holes, and the longer chamfer makes them cut easier and will reduce tap breakages; hence, this type of chamfer means real economy to the tap user. The straight part of the thread, which among tap users is considered as determining the life of the tap, because upon it depends the number of sharpenings possible before the tap is worn out, is, even with this longer chamfer, generally sufficiently long to meet all requirements.

Relief of Machine and Tapper Taps

Machine and tapper taps have a greater amount of relief than hand taps, usually one and one-half times that of hand taps. This also applies to the chamfered portion, compared with the taper tap in a set of hand taps. As the relief on these taps is greater, it is necessary, when sharpening them, to grind away very little from the front face of the lands, as this will aid in giving to these taps a longer life. However, the amount to be ground away on the front face is determined by how much the tap has been worn.

Important as it is to give taps the proper amount of relief, it is equally important to give them the right kind of relief. Because of the ease and freedom with which ground taps cut, they will often cut away on the sides of the thread in the nut, on the end from which the tap is started, unless they

are given the right kind of relief.

In Fig. 3 are shown three different kinds of relief. The type shown at *B*, which is probably used most extensively by tap makers for both straight and taper taps, is not, in the author's opinion, as good as that shown at *A*, but neither of these two, in his estimation, can be compared with the type shown at *C*. A tap provided with the latter kind of relief not only cuts better, but also shows less tendency to produce holes that are out of round. The material being cut does not stick and cling to the angular sides of the tap threads as much as it is likely to do when the relief is made as shown at *B*, and the tap will cut a better and rounder hole than with the relief as shown at *A*.

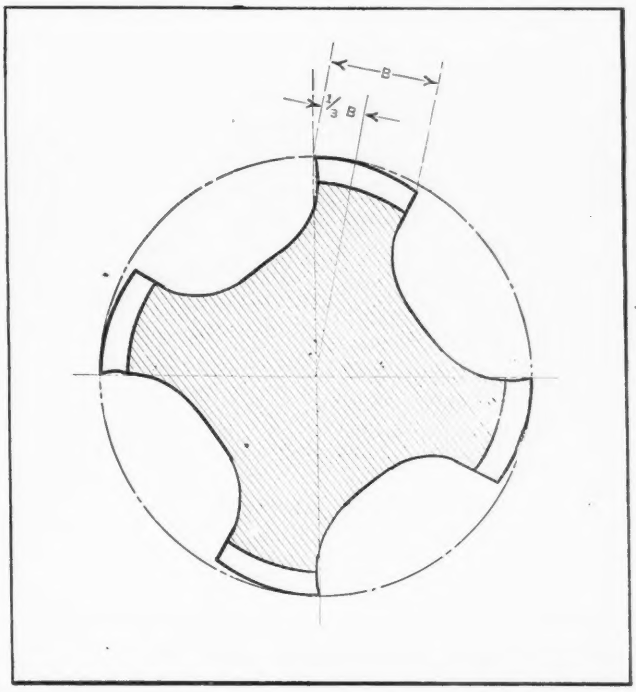


Fig. 2. The So-called "Con-eccentric" Relief Sometimes Used on Taps

Referring to *A*, the radius of the relief is equal to the radius of the tap. At *B* the radius of the relief is smaller than the radius of the tap. At *C* the radius of the relief is greater than that of the tap. It will be noted that this method produces less relief at the back of the land than either of the other two methods.

The Over-Size Allowance on Taps

When the life of a tap is considered from the point of view of how many times it can be sharpened before it is worn out, it is necessary to consider not only the amount of relief, but also the amount that the tap is over size when new. Comparatively small relief is customarily and necessarily provided on straight-fluted ground taps, first, because such a tap would "jump" when threading a hole if given too much relief, and second, because it is necessary to prevent the clogging of chips between the lands and the threads in the work when backing out the tap. On round spiral-fluted taps, comparatively small relief is also provided, because of the greater efficiency of this type, which requires less relief. This small relief makes it possible to grind away, for sharpening, practically the whole width of the land of the tap without making it under size.

It should, however, be pointed out that the amount that the outside diameter is over size should be greater than the amount that the pitch diameter is over size on all types of taps, with any

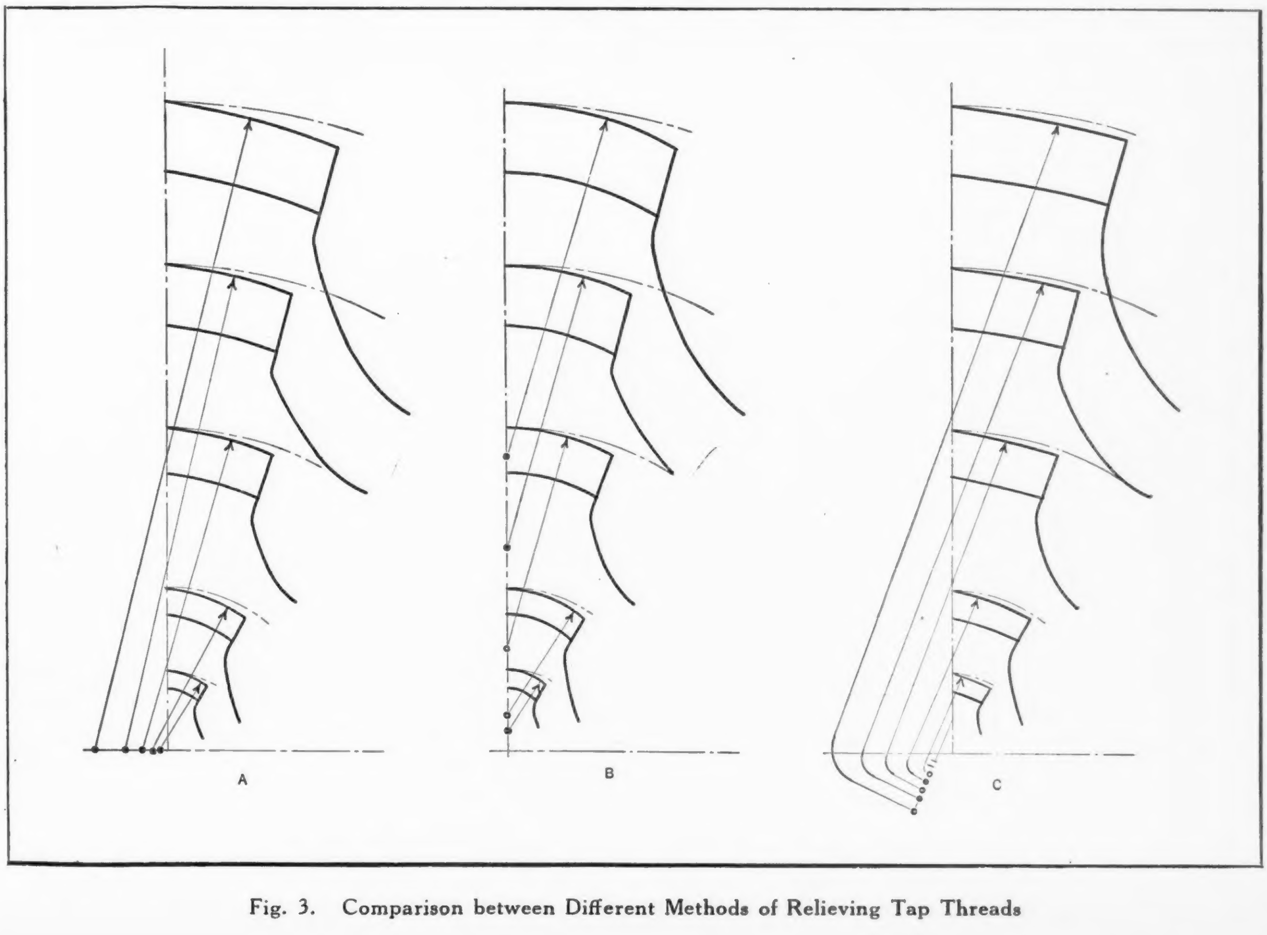


Fig. 3. Comparison between Different Methods of Relieving Tap Threads

form of thread. This was referred to in the previous installment. The principal reason for this is that the flat or round exterior of the thread form wears faster than the angular sides. On all thread forms with flat tops, this method of tap construction has been in common use for many years; by following this practice, there is assurance that the threads of the screw will bear only on the angular sides of the nut threads and not on the tops.

With the Whitworth and other formed thread standards, this method has not been in common use, probably on account of the methods formerly employed in producing the threading tools for cutting these threads. When these thread forms are ground, however, there are no manufacturing reasons for not providing the extra clearance or additional over-size on the outside diameter. At least one leading European manufacturer produces taps in accordance with this practice.

The Root Diameter of Taps

In order to insure a good fit between the angular sides of the threads in a screw and nut, it is not only necessary that the outside diameter of the tap be larger than the nominal size, but that the root diameter be larger as well, and in the case of Whitworth and other thread forms with rounded points, the radius must also be larger than the nominal radius. Should it be less (and this is not uncommon) and should the hole to be threaded have been drilled or forged too small, a screw of correct nominal size cannot be screwed into a hole threaded with such a tap, in spite of the fact that the tap is large enough in all other essential elements.

Generally the root diameter of a tap and the form of the thread at the root have been considered of small importance, because the hole to be threaded, if correct, would be drilled or bored larger than the theoretical root diameter. When the hole is drilled or bored larger on a Whitworth form of thread, for instance, in spite of the fact that the root diameter and the form of the thread of the tap are correct, the tops of the threads in the threaded hole (at the root diameter of the thread in the nut) will be flat instead of round.

Clearance and Tolerances—Back Taper

Figs. 4 and 5 clearly show the clearance or play that should exist between the top of the thread on a screw and the outside diameter in the hole of a Whitworth thread, as compared with a United States standard thread. In these illustrations, *A* shows the maximum outside diameter of the tap; *B*, the minimum outside diameter of the tap; *C*, the maximum outside diameter of the screw; *D*, the minimum outside diameter of the screw; *E*, the maximum diameter of the hole in the nut; *F*, the minimum diameter of the hole in the nut; *G*, the maximum root diameter of the screw; and *H*, the minimum root diameter of the screw. The heavy line indicates the tolerance allowed on high-grade ground hand taps.

The area cross-sectioned with vertical lines shows in Fig. 4 the tolerance (easy fit) for screws made according to "American Standard Screw Threads," adopted by the American Engineering Standards Committee May, 1924 (see publication B1a 1924). The maximum and minimum dimensions of the hole in the nut are according to the same standard. In the International System of screw threads, the hole in the nut is equal to the theoretical root diameter plus 0.09 times the pitch (see Schuchardt & Schutte Handbook, Sixth Edition).

The maximum and minimum diameters of the hole in the nut and the outside and root diameters of the screw are the same for free, medium, and close fits, according to the same publication of the American Engineering Standards Committee referred to in the foregoing. Hence, the contact surfaces on the thread sides will be the same in all three fits specified in the standard mentioned.

Referring now to Fig. 5, the area cross-sectioned with vertical lines shows the tolerance on screws according to the British Engineering Standards Association (see Table 2, C. L. (M) 7270). The maximum and minimum hole in the nut is also according to the British Engineering Standards Association, Table 3, in the publication referred to.

In order to eliminate, as far as possible, the friction between the tap and the nut while tapping, all

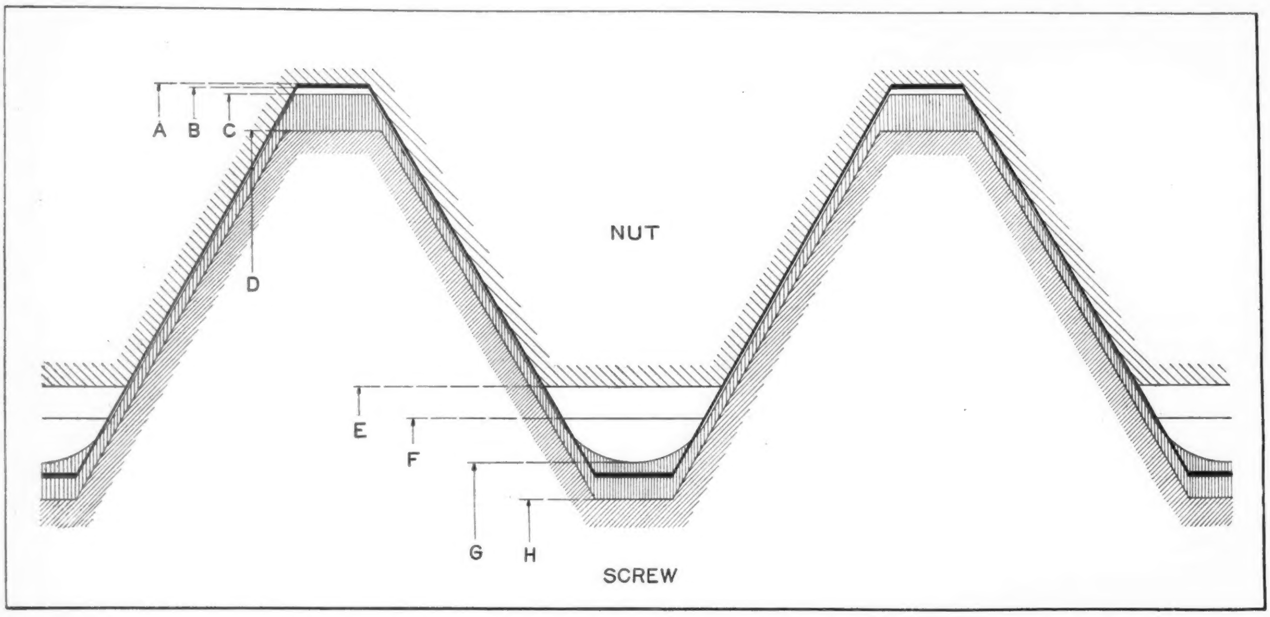


Fig. 4. Clearance and Tolerances on United States Standard Tap, Nut, and Screw Threads

taps should have a slight back taper, that is, the diameter of the threaded part should, in all its elements, be slightly smaller in diameter at the shank of the tap than at the cutting point. The amount of this back taper on hand taps, for example, should be 0.00025 inch on a 1/4-inch tap, and 0.0005 inch on a 1-inch tap—other diameters in proportion. On nut, tapper, and machine taps, these amounts should be double for the same length of thread. Aside from reducing friction, this slight back taper on taps materially reduces the tendency of the material in the nut to attach itself to and weld itself between the threads of the tap, which is not an uncommon occurrence when nuts are being tapped in high-speed up-to-date nut-tapping machines.

Different Types of Ground Thread Taps

Ground taps are now manufactured in all types, sizes, and lengths, and with all thread forms, by nearly all prominent tap manufacturers. One European firm has successfully solved the problem of making ground taps of extremely long dimensions, such as staybolt taps; such taps have been made in lengths of over 7 feet with a 1 3/8-inch diameter, which is quite a record, considering that the tolerances have been held to the same extremely small limits, both in the lead and on the diameter, as are used for ordinary ground taps of this firm's manufacture (see the last installment of this article).

The principal thread forms used in different countries are recorded in many books and catalogues, and it is not therefore necessary to repeat the thread profiles here. The three principal systems are the United States Standard, principally used in the United States; the Whitworth Standard, used largely in England, the Scandinavian countries, and on the continent of Europe; and the International and French Standard Systems, which are used in France and Belgium and to a small extent elsewhere on the European continent. All of these thread forms can be successfully ground to the limits previously mentioned as practicable for ground taps.

Acme and Square Forms of Thread

Apart from the thread forms mentioned, which are universally used, the Acme and the square forms of thread are employed to a considerable extent. The square form has been almost entirely superseded in the United States by the Acme thread for very good reasons—one being that the holding power and strength of the Acme thread is much greater than that of the square thread, and another, that it is much easier and cheaper to manufacture both screws and nuts (as well as the taps for tapping the nuts) when the Acme form of thread is used. It is, therefore, surprising to note how persistently European manufacturers insist on maintaining the square form of thread, as it is impossible to obtain good fits with it. Greater play between the threads in the screw and in the nut is unavoidable.

Standardization committees in different European countries have done a great deal toward abolishing the square thread system by standardizing the Acme thread form. In so doing, however, they have made what, in the author's opinion, is a serious error, by adopting a thread angle of 30 degrees, in spite of the fact that such important sections of the industrial world as the United States and England have for many years employed an Acme standard thread with a 29-degree angle. The 30-degree angle introduces a new thread system, and an unnecessary one.

The duty of standardization committees surely ought to be to simplify and not to complicate, as has been done in this case. A thread form that already existed and that, through long use, had proved to be practical, ought to have been adopted in the interest of industrial economy, especially when no other similar standard form of thread existed.

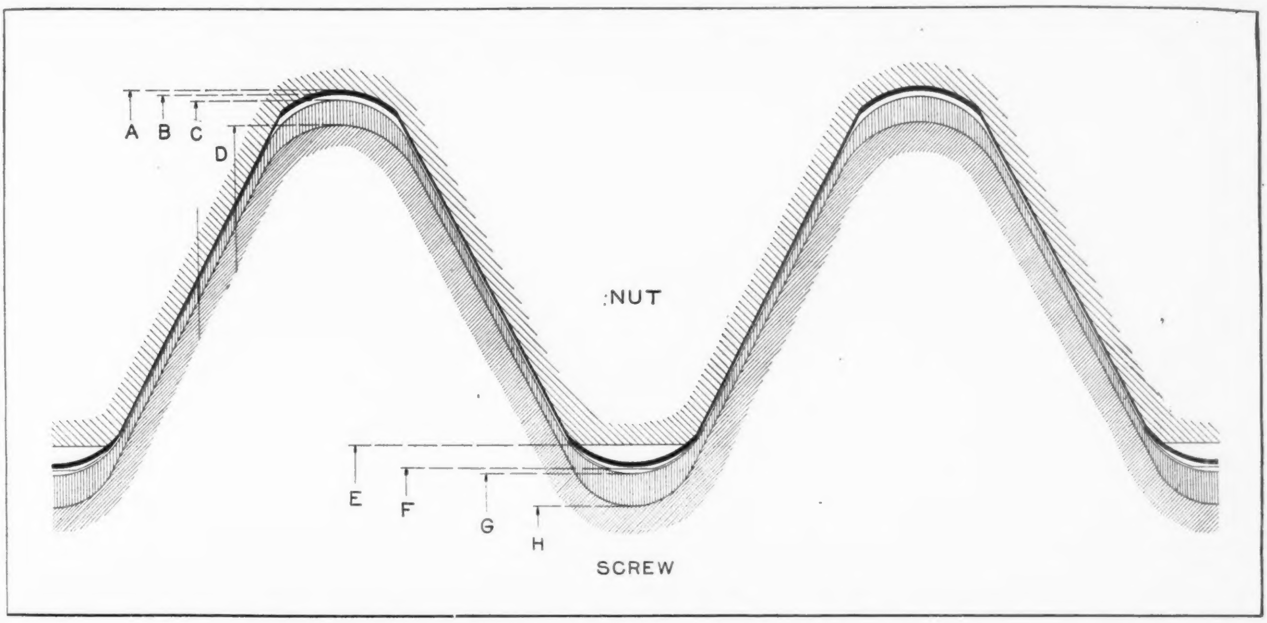


Fig. 5. Clearance and Tolerances on Whitworth Standard Tap, Nut, and Screw Threads

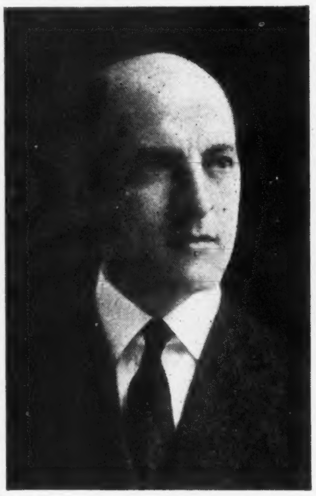
* * *

The total number of students at the thirteen leading engineering schools of Germany for the season 1926-27 was 28,429, which is more than twice the average number of students in these engineering schools previous to the War.

Net Profits from Small-Lot Production

First of Two Articles Dealing with Savings Due to Improved Methods

By W. J. BURGER,* Works Manager, Warner & Swasey Co., Cleveland, Ohio



MANY thousands of metal-working shops are faced with the problem of producing small lots of work, running from five to thirty-five pieces in a lot, in competition with companies enjoying large-scale production. Even though a plant may employ as many as a thousand men, the work often goes through in lots of only from five to thirty-five pieces at a time. This production in small quantities presents a difficult problem to the mechanical executive. He realizes the advantages of the highly developed methods of the quantity producers, but serious questions arise in his mind as to the practicability of setting up modern machine tools for lots as small as from five to thirty-five pieces. Will the faster cutting time offset the increased set-up time required by the newer and better method? Can he keep the more productive equipment busy on the types of work actually going through the shop? And most important of all, will the investment required bring him a real net profit? Even though the old equipment may have paid for itself long ago, any investment in new equipment must be justified on a basis of net profits which can be proved to the owners of the company.

Yet, the savings from the use of modern machine tool equipment cannot be denied, and the answer to the small-lot problem lies largely in using the same machine tools as are employed by the quantity producers, but with different tooling equipment. The recognized production advantages of the modern machine tool can be obtained in small-lot work without a heavy investment in highly developed or special tools, and under ordinary conditions, one machine and one set of tools can handle all the work. Standard tools today are not to be confused with those of earlier types—the modern tools can handle a great range of work.

A Typical Example of Small-lot Production

In order to prove the possibilities of using modern equipment for small-lot work under ordinary conditions, let us take an actual example from the plant of the Worthington Pump Corporation, investigating the facts as regards set-up time, variety of work handled, and net profits obtained. The illustrations that follow do not represent maximum possibilities, but are selected for this discussion because they are actual, thoroughly typical examples, as shown by intensive studies of small-lot production covering a period of three years.

A suction and discharge valve, Fig. 1, is made from a very tough tool steel in lots of ten pieces. In the first method used, the stock was gripped in a three-jaw chuck, as shown in Fig. 2. Three cutters were used in the lathe toolpost and the drills were mounted in the tailstock. With this method the total time for making ten pieces was ten hours. The machine and tooling equipment required called for an initial investment of about $1200, and, of course, handled a great variety of bar and chucking work. However, the first method provides only for single cuts, and in order to bring the pieces to size, trial cuts are necessary for the outside diameters and shoulders. No attempt was made to bring the work to size in the first operation, because of the drilling operations in the tailstock. The piece was mounted on centers in a later operation and brought to size.

Fig. 3 shows the second method, in which the job was put on a turret lathe. The same operations are performed, but a square turret toolpost is used to hold the three cutters, and the drills are mounted in the hexagon turret. While the first piece is made, positive stops are set for the longitudinal travel of the hexagon turret. Positive stops are also set on the side carriage of the machine to control the longitudinal position of the cutters for shoulder lengths. The accuracy of the diameter of the finished work is controlled by the screw feed of the side carriage and marked by clips on the dial.

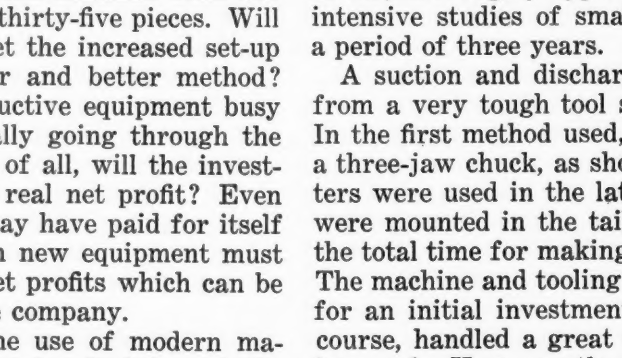


Fig. 1. Suction and Discharge Valve Produced by Tooling Methods Shown in Figs. 2, 3, and 4

*W. J. BURGER was born April 2, 1881. He began his apprenticeship with the Warner & Swasey Co. in 1899, and after completing it, progressed successively to positions of increasing responsibility until he became chief inspector, demonstrator, and subsequently head of the sales engineering department. In the latter capacity he specialized in the design of small tools and rapid production methods, and also made exhaustive studies and original research in metals. In 1915 he began making important improvements in production methods and introduced the bonus system in the plant. During 1917 and 1918 he devoted much time to devising equipment and supervising the manufacture of military instruments of precision. In 1918, he became assistant superintendent, and in 1920 was made production engineer. In 1921 he was appointed assistant works manager, and in 1923 he became works manager, which position he now holds.

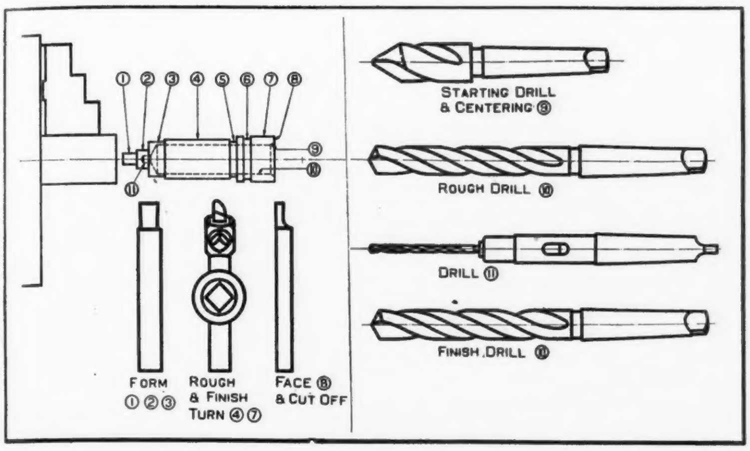


Fig. 2. Tooling Lay-out for Suction and Discharge Valve, Machined in an Engine Lathe in Lots of Ten

These set-up operations, under actual shop conditions, with an ordinary operator, took forty-five minutes. The question now arises as to whether it paid to set up the turret lathe for this short and simple job.

First Method (Fig. 2):	
Machining time, including shifting cutters, trial cuts, etc., 60 minutes per piece × 10 pieces	600 minutes
Second Method (Fig. 3):	
Set-up time:	
Changing collet and mounting tools	15 minutes
Adjusting tools to size.......	17 minutes
Setting stops...	13 minutes
Total set-up time	45 minutes
Machining time, 25 1/2 minutes per piece × 10..	255 minutes
Total time, including set-up......	300 minutes

Thus, after deducting the set-up time, the total cost was cut in half. Experience shows that the second method is more economical in many cases when only from two to five pieces are produced.

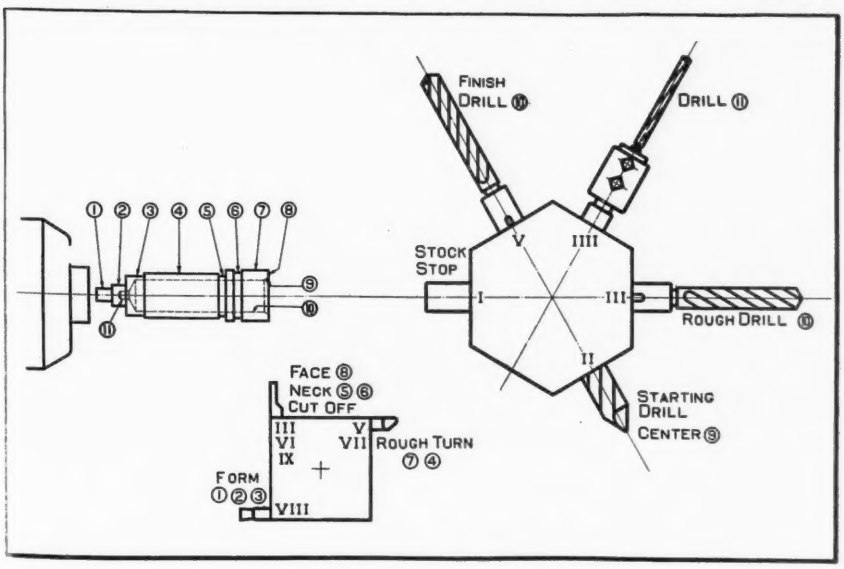


Fig. 3. Tooling Lay-out for Machining Suction and Discharge Valve in Lots of Ten on a Turret Lathe

Advantages of Second Method

The question arises, "Why was the machining time cut from 60 minutes per piece, to 25 1/2 minutes per piece?" The work is quite simple and does not offer the possibility of taking multiple cuts, that is, two or three cuts from the same tool station at the same time. A study of the layout drawing, Fig. 3, shows, however, that there are possibilities for "combined cuts." While the tools in the square turret are turning outside diameters, the rough-drilling operation, the longest in the group, is proceeding with the drill held in the hexagon turret. Furthermore, in the second method, the necessity for trial cuts is eliminated after the piece has been once set up, and no time is lost in taking two or three cuts to bring the work to size or to get the shoulders properly located; the sizes of the diameters are determined by the clips on the dial of the screw feed, while the location of the shoulders is controlled by the positive stops on the side carriage. In addition, the feeding mechanism of the machine used for the second method provides a heavy feed for the drilling operations, and the use of lubricant keeps the tools cool.

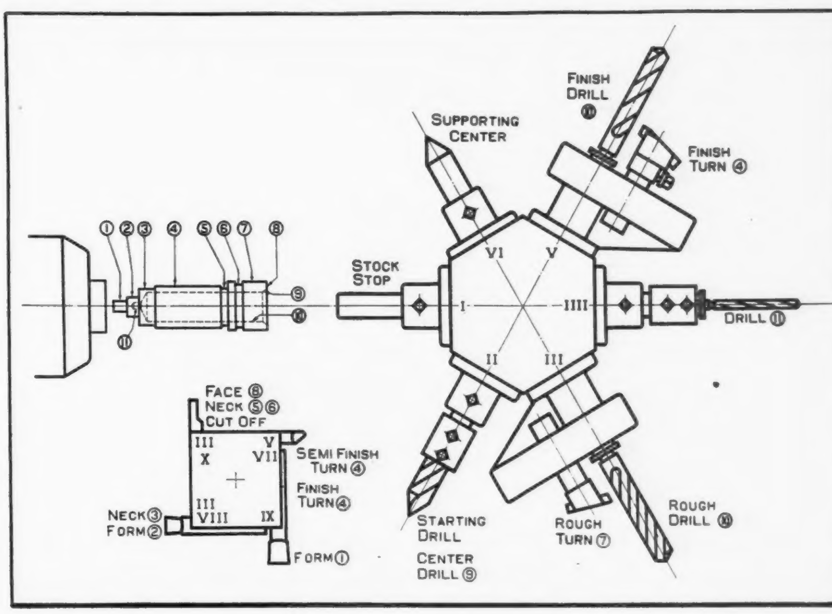


Fig. 4. Suggested Tooling Lay-out for Machining Suction and Discharge Valve in Lots of One Hundred on a Turret Lathe

A Third Method Suitable for Larger Lots

For purposes of comparison, let us consider a third method suitable for somewhat larger lots. When one hundred pieces are made in the lot, the tooling method shown in Fig. 4 is suggested. This method reduces the time from 25 1/2 minutes, as shown in the second method (Fig. 3) to 20.8 minutes, including the set-up time. Furthermore, the part is finished

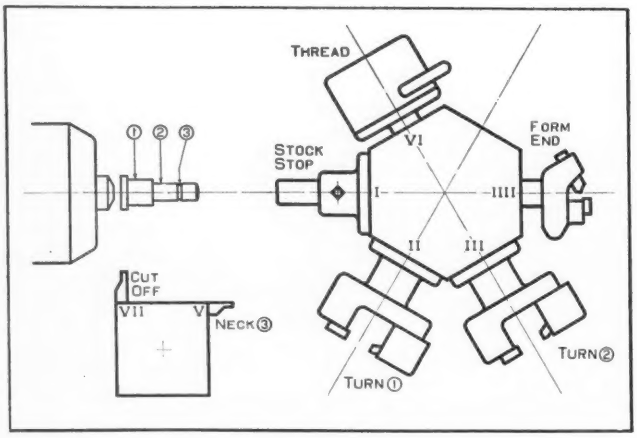


Fig. 5. Tooling Lay-out for Turret Lathe for Making Governor Connection Pins in Lots of Six

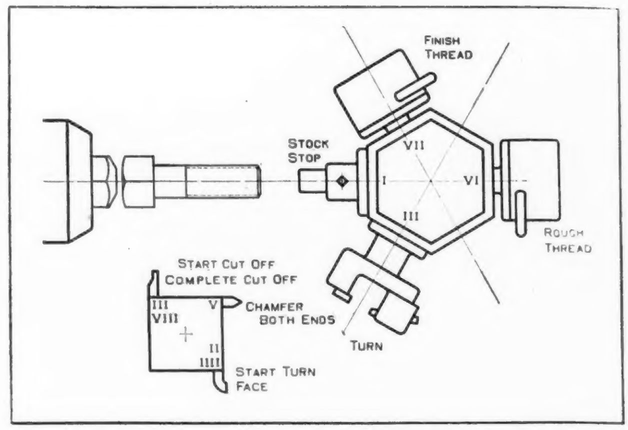


Fig. 6. Tooling Lay-out for Turret Lathe for Making Tap Bolts in Lots of Forty

complete without a second chucking—another substantial saving. The same machine is used, but the tooling is changed as follows: (1) A forming cutter is used in the square turret marked IX, to form Diameter 1. (2) Diameter 7 is rough-turned from position III of the hexagon turret, and is finish-turned from position V of the hexagon turret.

A simple standard tool (multiple turning head) is used to hold both the drill and the cutter for these two operations. The finishing cutter in position V of the hexagon turret is held in an adjustable angle-cutter holder which provides positive screw feed control of the cutting point in order to hold the work exactly to size with a minimum of set-up time. This tool lay-out requires three hours to set up. The tools in positions III and V of the hexagon turret must be mounted and the cutting points adjusted. All stops must be set, and with the slightly more complicated lay-out there is, of course, always some lost motion. The cost of the two multiple turning heads with the cutter-holders may properly be distributed over a wide variety of work.

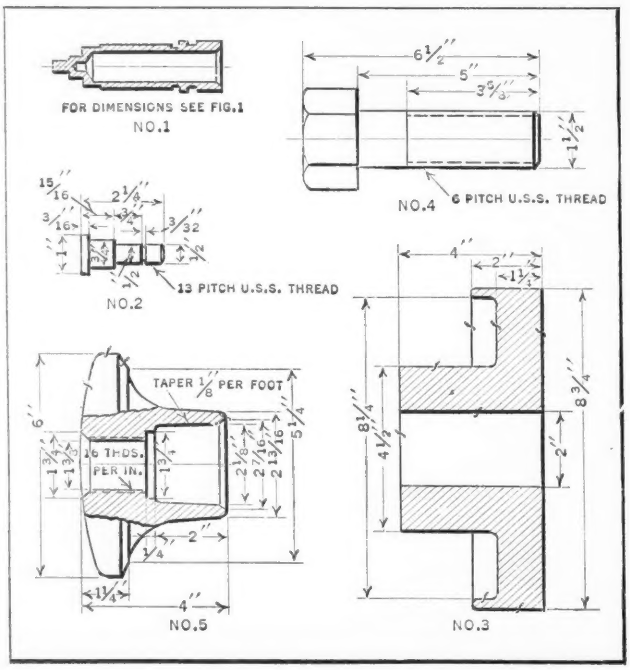


Fig. 7. Examples of Work Done at the Worthington Pump Corporation, on which Savings in Machining Time were Made by Improved Methods

While this method is suggested for lots of one hundred, for the sake of comparison, a few figures will show that it is thoroughly practical for lots of as few as forty pieces.

Set-up time for third method (Fig. 4) . . . . . 180 min.
Machining time, 19 minutes (floor-to-floor time) × 40 pieces . . . . 760 min.

Total time . . . . . 940 min.

This makes the total time required per piece 23 1/2 minutes.

Thus, for any lots consisting of more than forty pieces, the third method will prove to be economical.

The tendency in discussing savings in shop methods often is to pick out and emphasize extremely high savings. Hence, the mechanical executive naturally and properly asks, "What are the possibilities existing in the

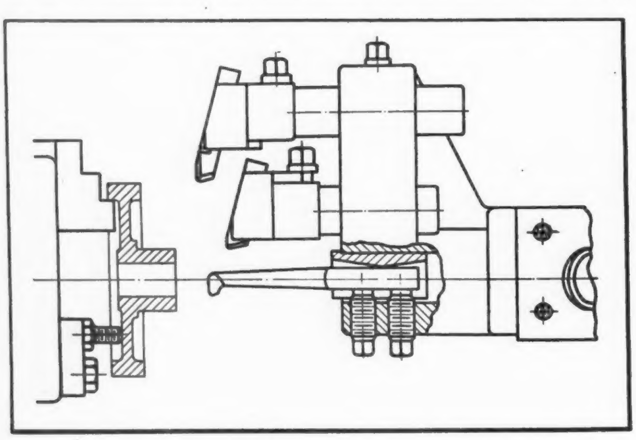


Fig. 8. Taking Several Cuts Simultaneously with a Multiple Turning Head Mounted in the Hexagon Turret

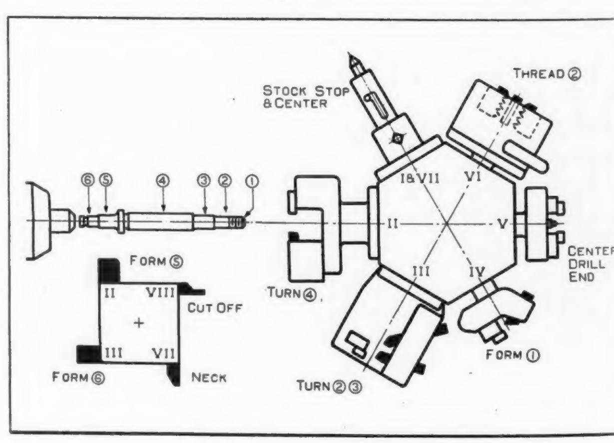


Fig. 9. "Permanent" Set-up—Cutters Shown in Heavy Black are Only Ones Changed for a New Job

average plant under small-lot conditions?" To answer this question, let us first examine the situation when the writer called one morning at the plant of the Worthington Pump Corporation. Seven jobs were operated on turret lathes. Five of these jobs had previously been done by the first method described (Fig. 2), and actual production time was available. The table shows the facts about these jobs, starting with the suction and discharge valve, while Fig. 7 shows drawings of the pieces themselves.

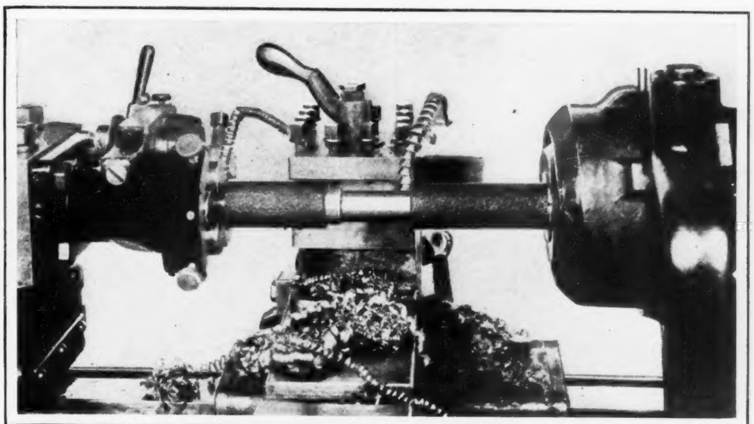


Fig. 10. Taking Combined Cuts by having Tool in Square Turret and Tool Mounted in Hexagon Turret Cutting at the Same Time

The table shows that the average percentage of time saved was 47, representing not exceptional performance, but results under typical small-lot conditions. Figs. 5 and 6 show the lay-outs for pieces Nos. 2 and 4, respectively.

Comparison of Savings by Improved Methods

No. of Piece (See Fig. 7)	Description	No. in Lot	Former Time, Minutes	Present Time, Minutes	Time Saved in Per Cent
1	Suction and discharge valve	10	600	300	50.0
2	Governor connection pin	6	132	90	31.8
3	Coupling halves, both chuckings	20	150	87	42.0
4	Tap bolt				
5	Exhaust valve, both	40	40	20	50.0
	chuckings	15	54	20	62.9
		91	976	517	47.0 aver.

Machinery

The Problem of Setting up the Machine

In order to take full advantage of the turret-lathe method, the problem of set-up time must be studied. The jobs shown were set up by an average operator, and the set-up time represents average results under existing conditions. In approaching the problem of set-up, it is well to divide the jobs to be done into two classes: (1) Work with from three to ten pieces in the lot. (2) Work with from ten to thirty-five pieces in the lot.

Where the lots are as small as from three to ten pieces, it is often advisable to utilize the cutters in the square turret instead of setting up the hexagon turret. Forged cutters may be quickly mounted in the square turret, and after a trial cut is taken, the set-up is quickly completed and the depth of the cuts is maintained by the clips on the dial of the side carriage. The location of the shoulders is controlled by setting the screw feed stops on the side carriage of the turret. This use of the square turret makes unnecessary the shifting of cutters for the trial cuts, and makes available the increased power and rigidity of the turret lathe. Hence, when the lots of work are very small, the use of the square turret often produces savings, because the set-up time is so low.

Where lots range from ten to thirty-five pieces, it pays to set up the hexagon turret fully. Experience shows that a great many shops use the turret lathe for small-lot production, but fail to take advantage of the tools already mounted on the hexagon turret. While this involves some set-up time, the use of the hexagon turret permits cuts to be taken from both the hexagon turret and the

Fig. 11. The First Step in a "Permanent" Set-up is to Change the Collet Bushings to the Size Needed

Fig. 12. The Second Step is to Sharpen Forged Cutters and Bits to Suit the Individual Needs of the Job

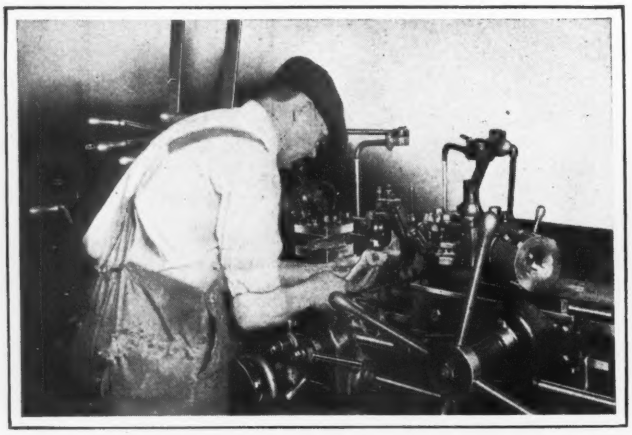


Fig. 13. The Third Step is to Set Cutters to Turn to the Correct Size while Machining the First Piece

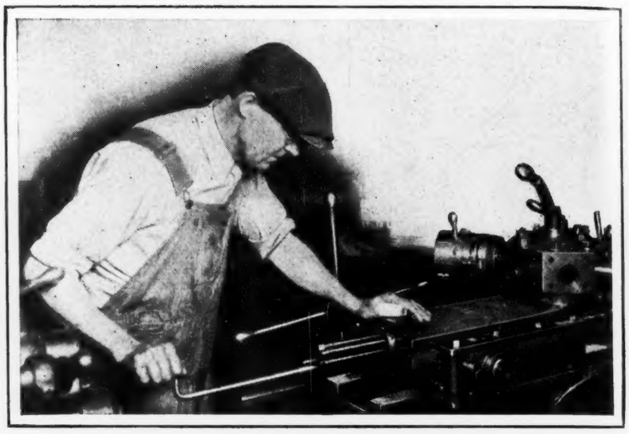


Fig. 14. The Last Step is to Set the Stops for the Longitudinal Travel of the Square and Hexagon Turrets

square turret at once. For example, Fig. 10 illustrates the principle of combined cuts. The tool on the hexagon turret is turning one diameter while the tool in the square turret is turning the other. This reduces the time to almost one-half for a considerable part of the bar work. The same principle also applies to chucking work.

Setting up the hexagon turret also frequently permits the use of multiple cuts, that is, taking two or three cuts from one tool station. Fig. 8 shows an example of this. The tool used in the hexagon turret, a multiple turning head, holds two cutter-holders for the two outside diameters, and also a forged boring cutter for the hole. Thus three cuts are taken at one time from the hexagon turret.

Two Suggestions for Reducing the Set-up Time

There are two practical methods of reducing set-up time for small lots. The first is to employ a skilled operator—not necessarily a high-priced man, but an operator of the type who has the ability to think out a satisfactory set-up when the job comes to him. Such an operator takes full advantage of the small-lot possibilities of the turret lathe through using both the hexagon and square turrets.

The second suggestion for reducing set-up time is to employ a permanent set-up, as shown in Fig. 9. This permanent set-up gives the arrangement of the bar equipment that is best suited for the majority of bar work. The set-up is left identically the same for the different jobs, and any tools that are not used for a particular job are left on the turret. If necessary, the turret is back-indexed to obtain the correct sequence of operations, in order to save remounting of tools. The tools suggested for bar work, for example, ranging up to 2 1/4 inches in size, are as follows:

1. Flanged tool-holder, with combination stock stop and center; for locating the bar from the chuck, and for supporting the work for necking, etc.
2. Single cutter turner; a rigid tool with roller back-rest for accurate work. The cutter can be withdrawn to prevent marring the work.
3. Multiple cutter turner; a substantial tool for turning or chamfering two or three diameters at once to accurate limits. Two roller carriers can be used on one tool.
4. End facing tool; for facing or rounding ends prior to threading. The flat cutter has a rocker adjustment for setting to center.
5. Center drilling tool; for centering ends of shafts concentric with outside diameter. The rolls are all adjusted at one time by a knob.
6. Self-opening die-head; used for roughing and finishing threading cuts.

The advantages of the permanent set-up are obvious. The time necessary to shift and remount tools is avoided, and in changing from job to job the only operations necessary are changing collet bushings; sharpening cutters; setting cutters; and setting stops. These operations are illustrated in Figs. 11 to 14, inclusive, which show in detail the actual set-up for the spool spindle used as an illustration. The total set-up time was only 49 minutes, with an operator of average ability, under conditions where the tools were mounted in the permanent set-up.

Successful small-lot shops, that is, shops actually making money under small-lot conditions, almost invariably keep their tooling equipment mounted on the machine, as suggested, in the form of a permanent set-up. Any other tools or cutters needed are available in a closet or locker immediately adjacent to the machine. When a group of turret lathes is used, it is good practice to provide a complete set of bar and chucking tools for each two machines. The production of the turret lathe, as well as of many other machine tools, is often needlessly restricted through lack of a small investment in the proper standard tooling equipment.

* * *

SOUND MANAGEMENT IN DEALING WITH MEN

The leading article in August MACHINERY is based upon the principles of management applied by the White Motor Co., Cleveland, Ohio, in dealing with its employes. This company has succeeded in reducing the average monthly labor turnover to only 3 per cent, which is stated to be the lowest labor turnover of any industrial concern of appreciable size in Cleveland. Everyone recognizes that a low labor turnover is conducive to economy in manufacturing and to quality of product, and the article, therefore, will prove of considerable interest to everyone engaged in industry who is responsible for maintaining a working organization through which the best results in output and quality can be obtained. The success of the White Motor Co. and its position in the automotive field vouches for the soundness of the principles applied.

Methods of Holding Tools and Cutters

Fifth of a Series of Articles

By FRED HORNER

THE present article is a continuation of a series descriptive of methods of securing tools and cutters, the fourth of this series having appeared in April MACHINERY, page 602.

At *A* and *B*, Fig. 26, is shown a simple combination of a taper shank and clutch drive used to hold a drill in the spindle of a portable drilling machine. The drill is very short and is intended for use where the limited amount of space prevents a longer tool from being employed. It is flattened so that it will engage the clutch of the taper socket.

At *C* is shown a taper-shank holder in which a taper fit and clutch arrangement is employed to hold the tool or cutter. The tapered nose of the shank receives a collar, as shown at *F*, which is forced up on the taper surface, causing the clutch to bind the cutter and pilot securely in place. A standard flat cutter and pilot used in this type of holder is shown at *D*, and a countersink cutter, which requires no pilot, at *E*.

Taper-head Screw Fastenings

There are various designs of fastenings composed of a screw with a tapered body or head, which, when moved inward, exerts a wedging action against a blade or other type of cutter. Some of the smaller boring-bars and heads are provided with this type of fastening, but the most familiar tools having this means of fastening are the "solid adjustable" reamers in which the blades are packed out with paper or tin foil, as required, and held down by screws. One of the methods of holding the blades in a reamer of this type is shown at *A*, Fig. 27, and another at *B*.

Double Taper Fastening

A joint or fastening which is really in a class by itself is shown at *D*. This design is employed on a circular threading tool which is secured to the slide-rest or cross-slide. When the clamping screw is tightened, the cutter is held securely in place by the friction created between the tapered surfaces, one on the inside of the cutter and the other on the outside of the cutter hub.

Taper Adjustments

The taper affords an excellent means of obtaining size adjustments on many kinds of tools. A favorite method of expanding reamers and taps to compensate for wear and to vary the cutting size within a limited range is to split the body of the tool at three or more places and expand the split section by a taper plug. In the case of a short tap, the plug may be fitted as shown at *E*. In this case, the body of the tap is split at four or six places. Some of the reamers having pilot ends

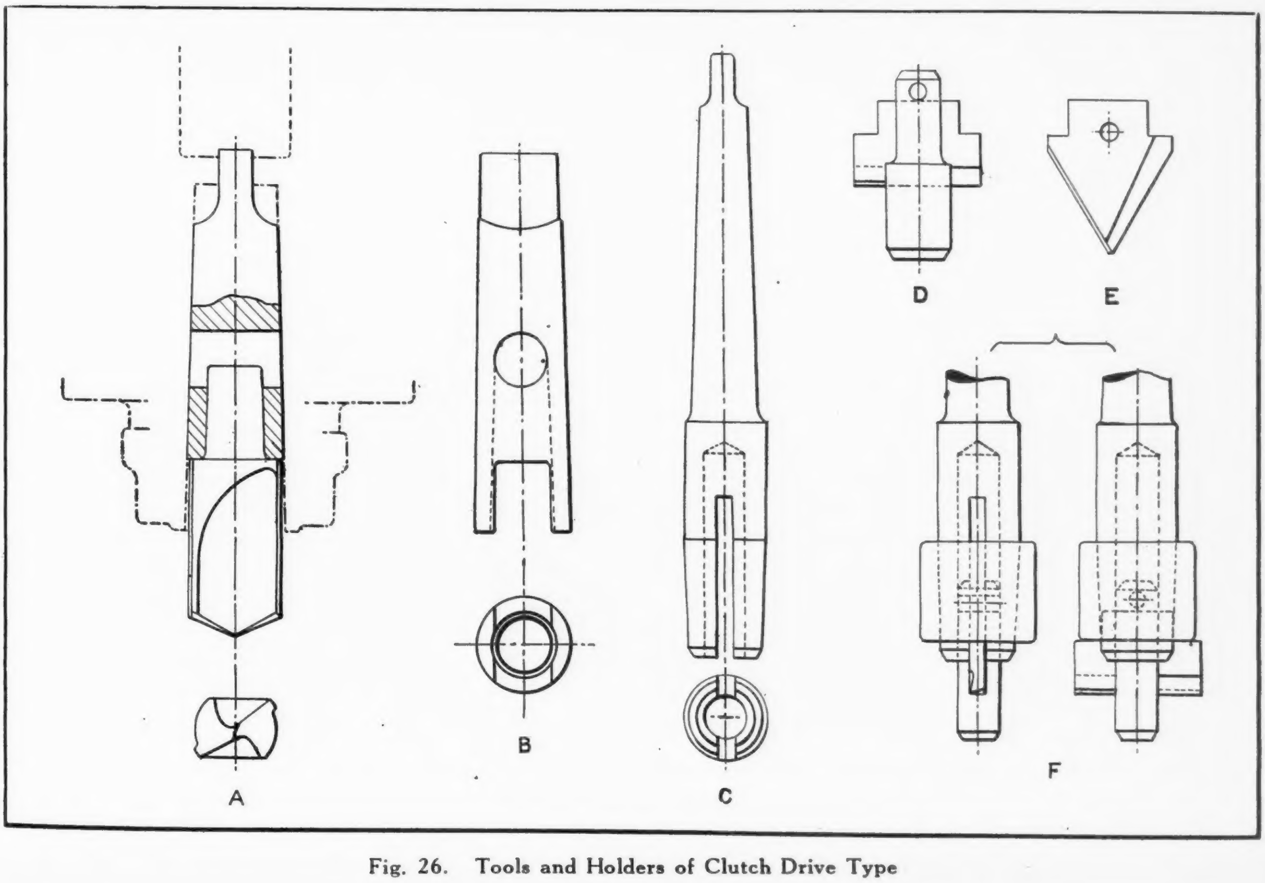


Fig. 26. Tools and Holders of Clutch Drive Type

are expanded about the central portion of the flutes instead of at the end. When it is impossible to pass the expanding plug through the body of the tool to permit locking it with the nut, the lock-nut may be located at the front end of the tool, as shown at *C*. In this design, the nut is tightened over the cone-shaped nose of the tool. Over-expansion is prevented in some types of tools by placing the lock-nut on the plug to prevent it from being advanced too far by a careless workman.

Another variation in the design of expansion tools is the provision of a full length plug, on the ground taper of which the blades rest. As the ground tapered plug is advanced, the blades are moved outward. Lock-nuts are employed on designs of this kind to prevent the setting from changing. At *F* is shown a type of expanding tool conical backs of the chasers are acted upon by the interior cone section of a ring threaded to move up and down a back plate or faceplate, lateral locking screws being used to bind the chasers in place.

Another example of taper adjustment is found in a die in which the four threading prongs are ground to an external taper matching that of the cap, the latter being moved along by a thread to obtain the correct size. Each land of the tool is supported rigidly with an equal pressure. In some cases, the prong dies are adjusted by a tapered thread instead of the usual split clamping ring or separate pressure screws held in a band. A modification of the usual design is found in a screw-adjusting collar in which tapers of different angles are employed, so that the pressure is exerted on the ends of the prongs, thus giving them the cor-

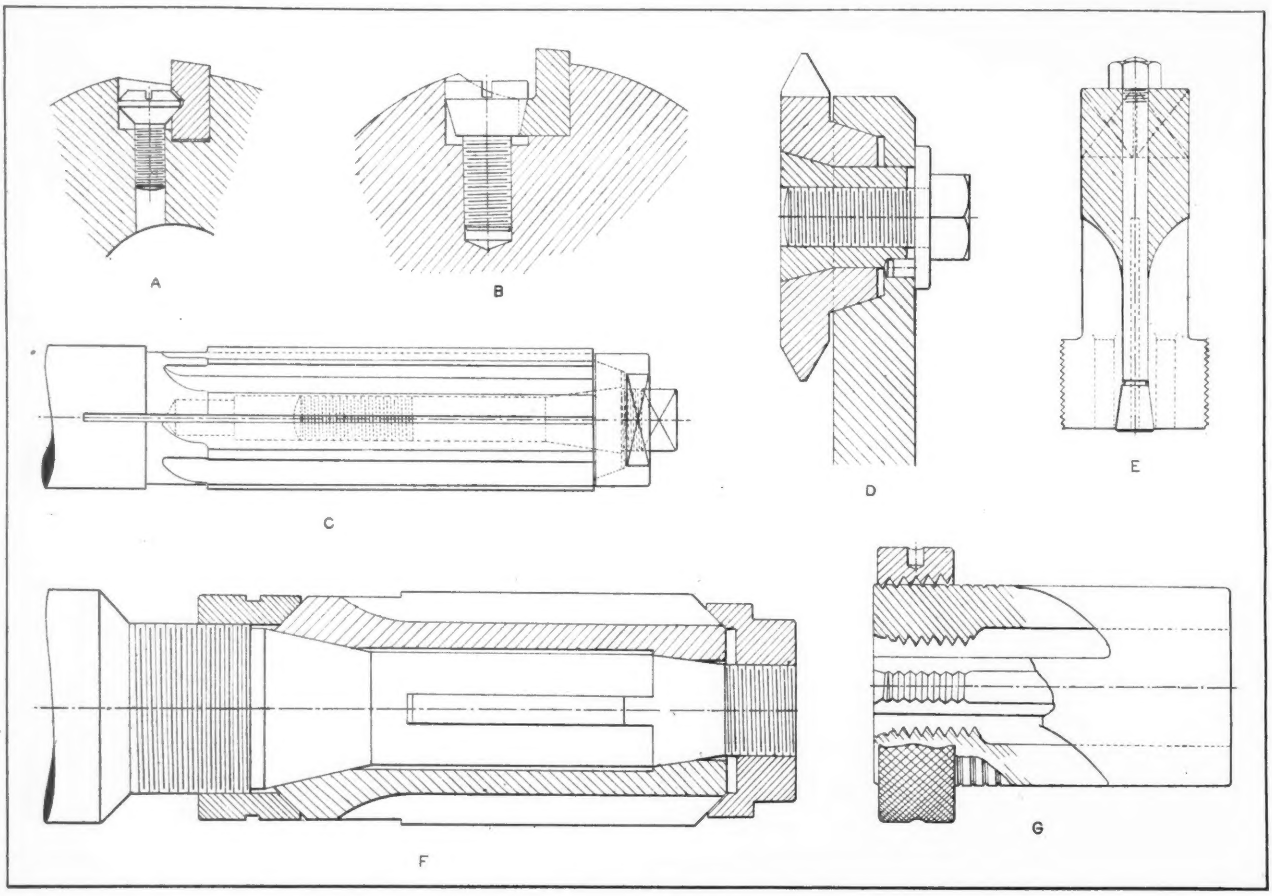


Fig. 27. Methods of Holding and Adjusting Tool Blades and Cutters

having lands on three or four pieces instead of single blades, which are expanded by the tapers at each end of the tool. The expanding action is obtained by the nuts at the end of each taper, the upper nut having micrometer graduations for use in obtaining the required size adjustment. Splines located on the parallel or cylindrical portion of the holder serve to prevent the lands from slipping around or twisting out of alignment.

Inserted-blade taps intended mainly for sizing purposes are also built on the taper plug principle, the chasers moving in slots and being returned by springs which press them against the expanding plug. A front locking plate is employed to secure the blades in position after they have been properly adjusted.

Dies are also constructed in a similar manner, except that the action is reversed—that is, the rect clearance and avoiding the gripping and tearing of threads when backing the tool away. The relative taper is somewhat exaggerated in the view at *G*.

Taper-body Screws for Obtaining Adjustment

Screws having tapered bodies are sometimes employed with success to effect the expansion of tools such as split slot sizing tools used on planers and lathes in order to obtain grooves of exactly the required finished width. In some cases, boring cutters are split and expanded a limited amount by the same method.

Threading dies can also be adjusted by one taper-body screw which controls the amount of opening at one side of the spring die. In some designs, a screw and nut, both of which are tapered, may be used to expand the die. Round or

button dies made in half sections are spread by a taper-body screw between each joint. In still other designs, a taper screw is used at one side and a grooved cheese-head screw at the other, the groove embracing lips or half rings machined on each member, as shown in the view at *G*, Fig. 28. This construction serves to keep the two halves of the die in proper alignment on the base ring or guide, and the die-stock, of course, grips the two members of the die when it is properly adjusted.

Wedge Fastenings

The wedge type of fastening is one of the oldest used in tool construction, the earliest boring-bars having been supplied with side wedges for securing the cutters in place. A fastening of this kind is shown at *A*, Fig. 29, although this wedge system has been largely superseded by other methods, particularly by the flattened cross-pin wedge system, which is easier to fit and does not tend to move the cutter radially while it is being driven into place.

Other applications of the wedge fastening are indicated in the views at *B* and *C*. The latter constructions are used on boring mill bars. Many boring heads and some milling cutters are still equipped with the front flank wedge type of fastening shown at *D* or preferably the slightly tapered wedge shown at *E*.

An unusual type of fastening in which the cutter itself is made in the form of a wedge and driven into place is shown at *A*, Fig. 28. This design is used for an inside facing operation in which the cutter must be put into the bar after the latter has entered the work and again removed from the bar before it is withdrawn. This type of cutter is used on the Hartness lathe. Flat wedges have been largely discarded in favor of the more easily machined round wedge pin. The tapered hole for such a pin can also be more easily machined.

Tapered pins are employed for fastening boring-head cutters and the teeth of milling cutters, as shown at *B*. The same method of fastening is also employed for the inserted blades of taps. When it is important to prevent lateral movement of the blades, a backing plate may be included, with or without separate screws. The backing plate may press against the end of the blade, as is done in the case of some of the larger face mills, or a set of locating notches can be cut in the back of each tooth for the reception of another wedge pin located in a recess in the bottom, which permits advancing the blades outward from time to time. This method of obtaining adjustment is shown at *D*. As a further assurance against lateral movement, the blade is sometimes provided with shoulders at the back as shown at *E*.

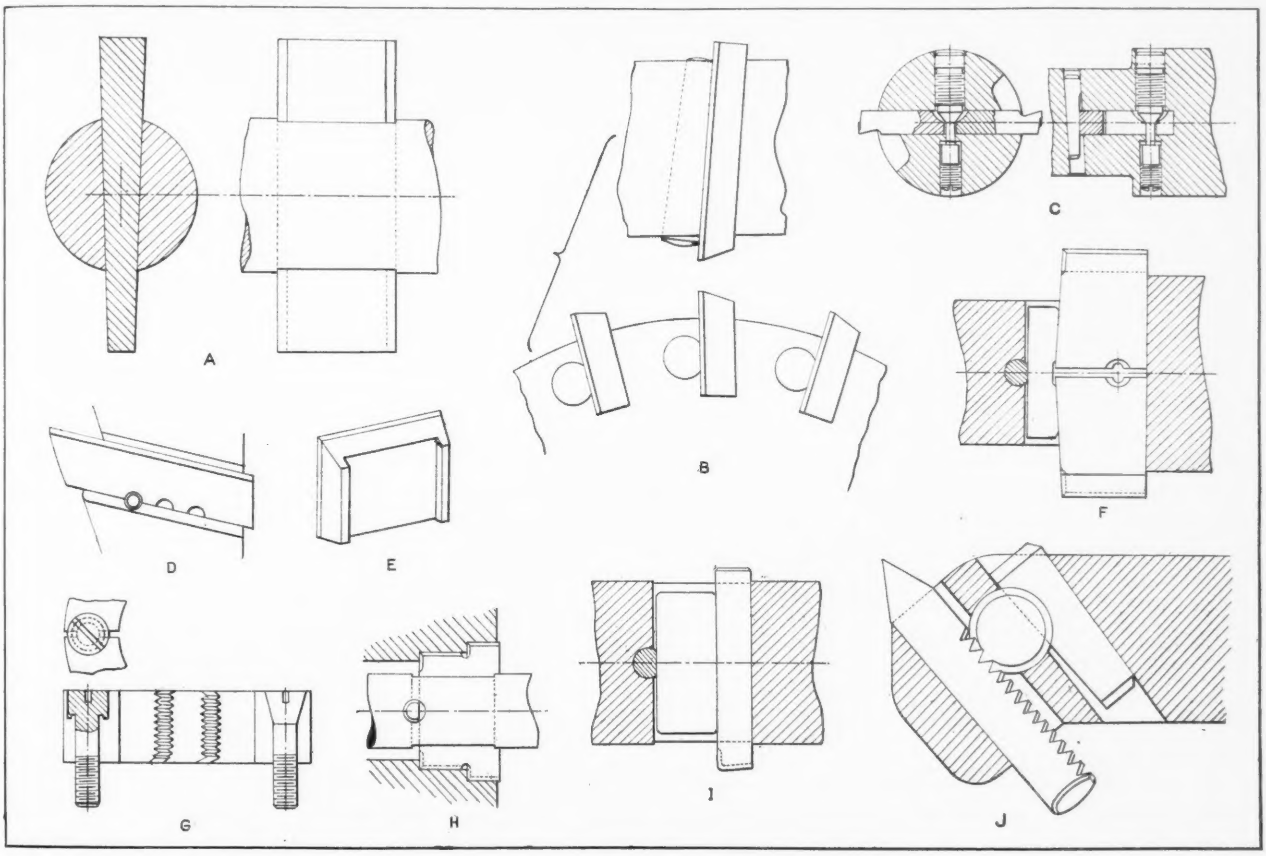


Fig. 28. Tools and Cutters with Wedge Fastenings

The severe strains to which the inserted teeth of cold saws are subjected necessitate the use of efficient fastening means. Although the teeth must withstand heavy service, the method of fastening them must be such that the disk is not subjected to undue strains; otherwise the teeth will be thrown out of alignment. Some form of tongue fitting is necessary to prevent lateral movement. In one of the simplest types of fittings, no separate wedge is used but the tooth is milled tapering from the top to the bottom and its front face is tongued to fit the groove in the plate, while the back edge is made slightly concave to fit a corresponding convex surface in the plate. Another design has a separate wedge with a tongue that fits into the tooth and the plate. There is also a lateral tongue on the front of the tooth that engages the plate.

The front faces of the inserted teeth of a certain type of cold saws on the market are finely serrated, in order to give them a firm hold in the pockets without requiring a heavy wedge pressure. The wedges are tongued to fit grooves in the tooth and the plate, and there is a nut and screw adjustment which regulates the height of the tooth. In another type of saw, the teeth may be secured by wedging or by wedging and screw height adjustment combined. In still another design, tongued wedging is employed, but no set-screw is used for height adjustment, as a "setting jack" is employed to adjust each tooth to suit a gage employed for the purpose. This arrangement is illustrated by the views *I* and *J*, Fig. 29. The double-ended gage is used in setting the wide and narrow teeth, respectively. The view at *J* shows a brass block in position for driving down the wedge, and also the setting wedge, which raises the tooth and holds it in position while the fastening wedge is being driven down.

The cross-pin type of wedge is particularly suited for fastening round, square, or rectangular cross-section cutters, as it is only necessary to drill a hole across the bar to receive the pin. Cutters can be set very close together with this construction, and may be adjusted by tapping or by means of screws, as shown in views *F*, *G*, and *H*, Fig. 29. Usually it is preferable to place the adjusting screw at the rear of the cutter, with its head fitting into a notch. This makes it possible to adjust the cutter in or out as required.

For double-end cutters, the centering may be accomplished by means of a cross-pin and vee notch or a pointed screw arrangement, as shown at *H*, Fig. 28. The section at *I* shows a method of securing a square-section cutter to a slotted bar with a shim. Shims are used in the boring-bars equipped with expansion cutters shown at *F*. In this design, the shim forms a lock joint which prevents the two half cutters from becoming loose. When a solid cutter is put in place, the wedge pin acts in direct contact with the cutter.

The shim arrangement is also employed with the expansion type of boring-bar shown at *C*. In this design, the cutter halves are spread or forced outward by the upper screw, which is locked in place after the required setting is obtained by the tip of the lock-screw bearing against the pilot end. A special wrench having a graduated dial is used in setting this tool, so that adjustments of 0.001 inch can be easily made. The total range of adjustment depends on the size of the bar, and is from 3/16 up to 7/16 inch according to the size.

Wedge Fastened Turning and Planing Tools

At *J*, Fig. 28, is shown a tool employed for turning and planing, in which the actual stress is borne by the serrated locking key, the wedge merely serving as a binder. This construction is also used in some cases on boring-bars and end milling cutters. Although a wedge strip, forced in radially, is one of the best means of locking the teeth of large milling cutters, it must, in many cases, be provided with retaining screws. The construction shown at *D*, Fig. 30, is used on a certain type of milling cutter. The bushings in this case are flattened to form wedges, which are first driven home and then secured in place by the screws. The extractor shown at *G* is employed to remove the wedges.

At *B* is shown a method of holding the blades in milling cutters made by an English concern. In this design, the wedging action is in the reverse direction from that ordinarily employed. In clamping the cutter in place, it is necessary to employ a key, as indicated. After the wedge has been drawn up in the clamping position, the key is removed and a headless set-screw inserted, as shown in the view at *C*. Any effort on the part of the cutter to rise only tends to increase the wedging action. In order to remove the blade, it is simply necessary to withdraw the screw and tap the wedge gently with a copper-faced hammer.

For clamping long pieces of stellite, a wedge bolt construction such as shown at *F*, is particu-

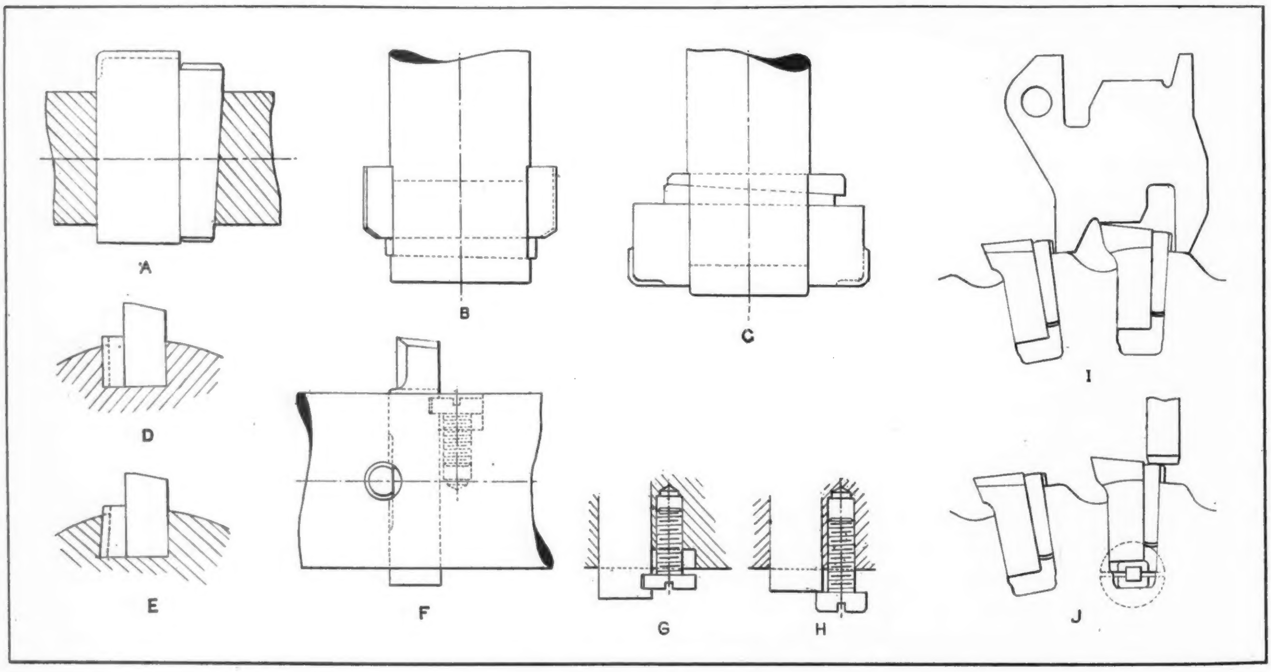


Fig. 29. Methods of Using Wedges and Screws to Hold and Adjust Cutters

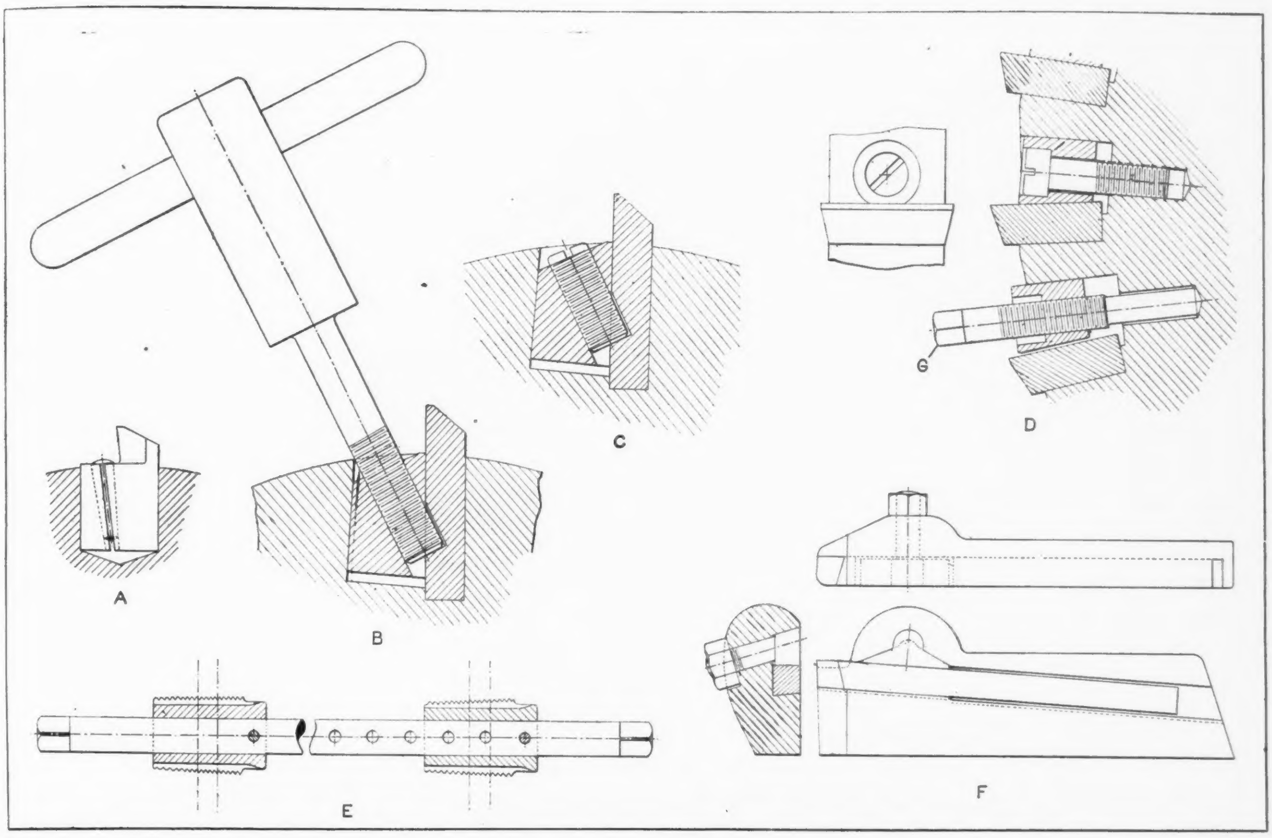


Fig. 30. Other Examples of Wedge and Screw Fastenings for Cutters

larly desirable, as it is not likely to fracture the stellite bit. The same type of holder can also be employed to advantage in some cases for side cutting tools. Taper pins are not used so extensively as a means of clamping in tool construction as in machine tool work. In some cases, however, they are used for spreading split tool bodies or for wedging teeth in place, as, for instance, in the design shown at *A*, this application being found on the porcupine type of slab mill. At *E* is shown a bar in which the taps are accurately positioned for pitch by pins.

* * *

STATISTICS OF THE MACHINE INDUSTRIES

The Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1926, the establishments classified in the "machinery, not including transportation equipment" group reported, for 1925, products valued at $5,020,281,100, an increase of 6.2 per cent as compared with $4,727,818,290 for 1923, the last preceding census year. The total for 1925 is made up as follows:

Foundry and machine shop products, not elsewhere classified, $2,232,985,974, a decrease of 4.5 per cent, as compared with 1923; electrical machinery, apparatus, and supplies, $1,540,002,041, an increase of 19.1 per cent; engines and water wheels, $313,587,851, an increase of 17.4 per cent; metal-working machinery (including machine tools), $175,592,488, an increase of 28 per cent; agricultural implements, $169,467,966, an increase of 12 per cent; textile machinery and parts, $121,653,324, a decrease of 13.5 per cent; pumps (hand and power) and pumping equipment, $120,148,157, an increase of 29.3 per cent; other products, $346,843,299, an increase of 12.4 per cent.

The total number of establishments classified in this group for 1925 is 11,807, of which 8154 belong to the foundry and machine shop products industry, 1739 to the electrical machinery, apparatus, and supplies industry, 379 to the textile machinery and parts industry, 378 to the metal-working machinery (not including machine tools) industry, and 303 to the agricultural implements industry. The total represents a decrease of 2.8 per cent as compared with 12,147 for 1923.

* * *

LONG-DISTANCE TRANSMISSION

A patent recently granted to Frank G. Baum, 1901 Hobart Building, San Francisco, Cal., and assigned to the Westinghouse Electric & Mfg. Co., covers an invention that solves the problem of transmitting economically large amounts of electric power over distances of several hundred miles, according to officials of the Westinghouse organization. Long transmission lines differ from short lines in many respects. It is entirely feasible to transmit large amounts of power over a simple set of wires for distances of 100 miles or so, but were an attempt made to do the same thing over a line 500 miles long, it is known that, due to the surges that would pass back and forth over such a line, the voltage conditions would become so erratic that the line would become inoperative.

Effects of this sort can be controlled to a certain extent by means familiar to all electrical engineers, but Mr. Baum's invention provides a method that is far more definite in imparting stability to long transmission lines than anything so far known. By means of it, the capacity of a given long line can be increased 75 per cent, according to the Westinghouse estimates, at a cost not exceeding 20 per cent of the original cost of the line.

Circular Welded-steel Machine Base

By R. E. KINKEAD, Chief Engineer, Welder Division, The Lincoln Electric Co., Cleveland, Ohio

MOST machinery manufacturers encounter some difficulties in changing from cast iron to welded steel design, but if a few fundamental principles are borne in mind, the problem becomes comparatively simple. The three fundamental rules that follow are used by the Engineering Department of the Lincoln Electric Co.

Rule 1—When rigidity is the determining factor, build the welded steel equivalent of the casting with the same outline dimensions but with only one-half the thickness of section.

Rule 2—When strength alone is the determining factor and rigidity is relatively unimportant, make the steel section one-fourth the thickness of the the cast-iron section.

Rule 3—When strength is the determining factor but rigidity is a secondary consideration, make the steel section one-third the thickness of the cast-iron section.

Fig. 1 shows an automatic carbon arc welding machine for welding head seams in cylindrical tanks. The turntable on the base revolves the tank about its vertical axis so that the top head seam passes continually under the welding head. The illustration shows welded steel construction. The base is standardized for several sizes of machines, and carries dead load tank weights up to 7000 pounds. This base must meet the following conditions: It must carry the operating load without appreciable distortion; withstand shipping without being broken; withstand mounting on a foundation without distortion; withstand having the tank set down with a jolt by an overhead crane, at the edge of the revolving table.

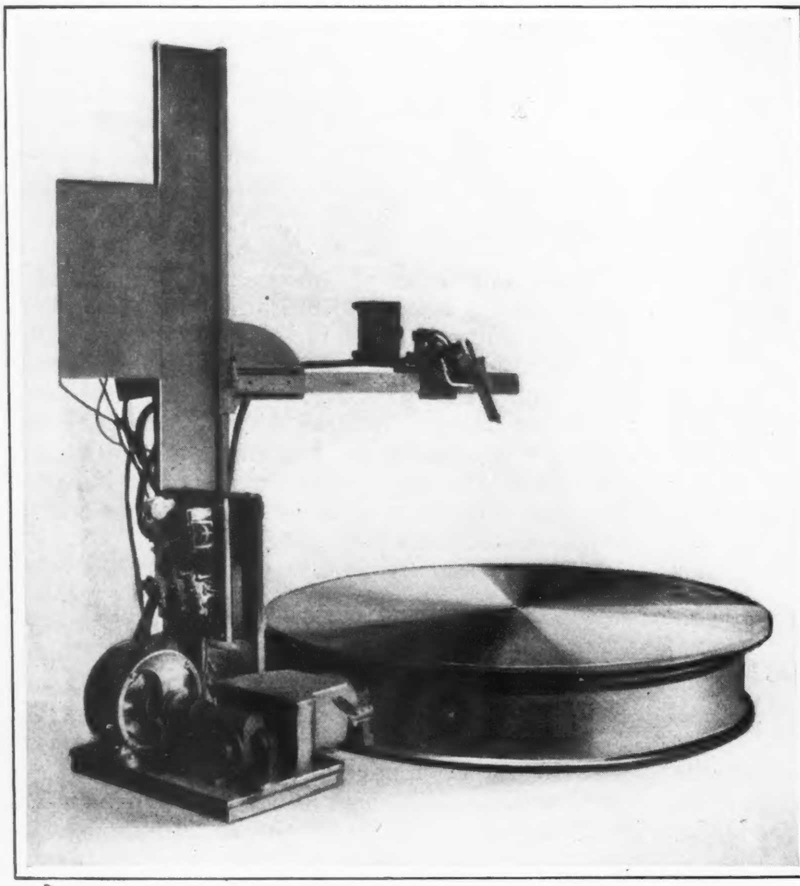


Fig. 1. Automatic Welding Machine Having Circular Base and Table of Welded-steel Construction

It is evident from the service required of this base that rigidity is an important factor, as any appreciable distortion would cause the top seam of the tank to wobble and run out from under the welding head. Distortion due to improper foundation and excessive tightening of the nuts on the foundation bolts must be guarded against in so far as possible.

Design of Turntable Base

Sectional views of the base which supports the revolving table are shown in Fig. 2 as designed for cast iron and also for steel (see two lower views). Referring to the cast-iron design, it will be noted that a heavy section is required. The necessity for the heavy section is due to the emergency condition previously referred to, which required a base to resist the impact of a tank suddenly lowered upon it. Under the usual conditions of installation, it is improbable that the bottom of the base will bear on the foundation all the way around. In this case, the unsupported sector becomes a beam section, and a heavy cast-iron section must be provided to prevent the base from being broken.

Referring to the steel design of the turntable base (Fig. 2), it will be noted that the thickness of the ring section in steel has been reduced to one-third the thickness of the cast-iron ring section, as Rule 3 is applicable to this base. From the standpoint of strength alone, the steel section could be made only one-fourth the thickness of cast iron, but considering stiffness as well as strength, the use of one-third the amount of steel was decided on. The cast-iron section is duplicated by the use of three rings *A*, *B*, and *C*, rolled up from flat stock and welded together as shown. The center bearing *D* is a piece of tube, and the stiffening bars *E* are plain bar stock cut to size and welded to bearing *D* and ring *B*.

Design of Turntable

Rigidity is the determining factor in the design of the turntable. The top surface of the table required a machine finish, so that a large allowance (1/2 inch) must be made in the casting to insure

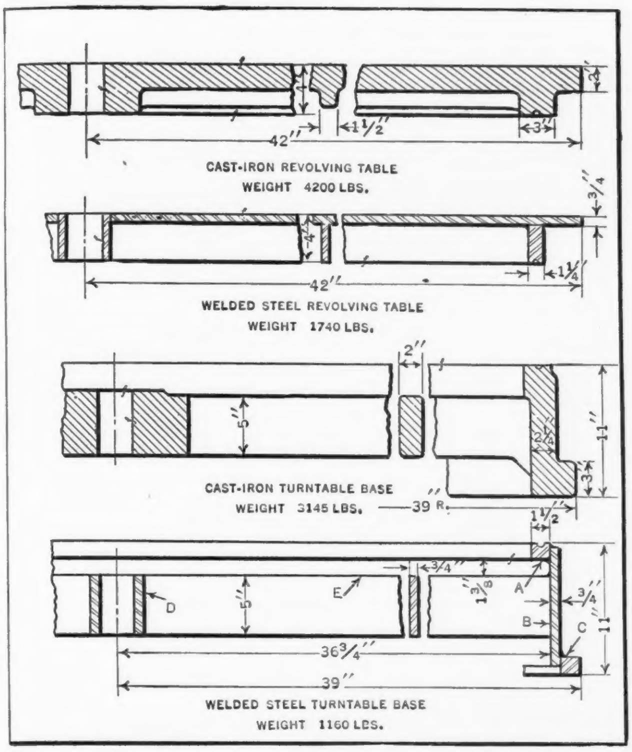


Fig. 2. Sections of Cast-iron Table and Base and of Steel Construction which Replaced Cast Iron

a clean surface. On the steel table 1/8 inch proves sufficient. This is due to the uniform quality of steel as compared with gray iron castings.

Rule 1 is applicable to this turntable; however somewhat less than one-half the cast-iron thickness was used in this case with satisfactory results, because in spite of the heavy section allowed in the design of the cast-iron table, this table would break if a large tank were dropped from a height of a few feet on it, whereas with a steel table, the most that would happen would be distortion or bending which could be remedied by straightening.

Fig. 3 shows the steel parts of the table before and after welding (upper and central views), and

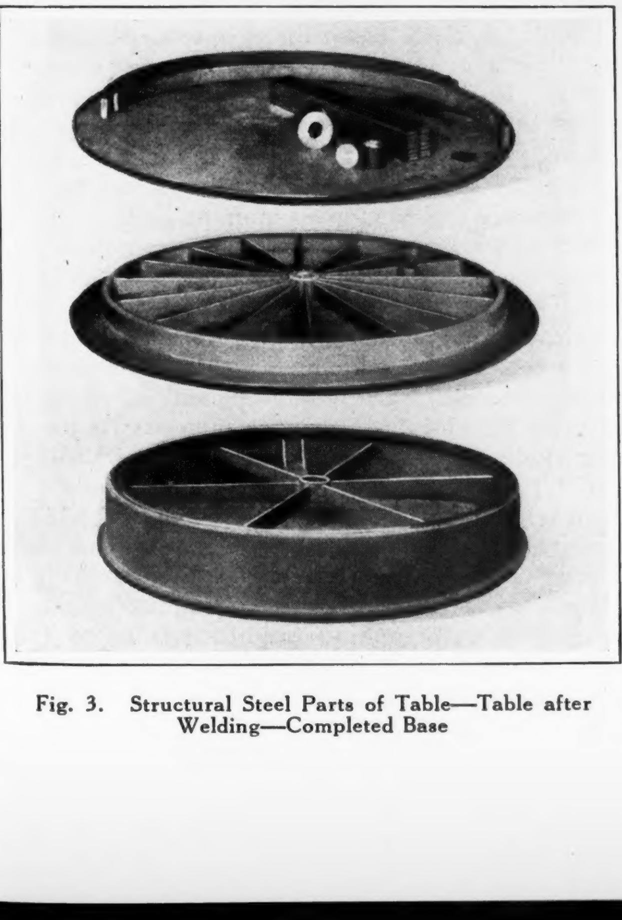


Fig. 3. Structural Steel Parts of Table—Table after Welding—Completed Base

the welded base (lowest view). Ordinary warehouse steel was used in constructing these parts. A summary of costs follows:

Turntable base—Weight of rough casting, 3145 pounds; cost of rough casting, $252; weight of welded steel base, 1160 pounds; cost, welded (includes labor, power, all material, and overhead), $69.

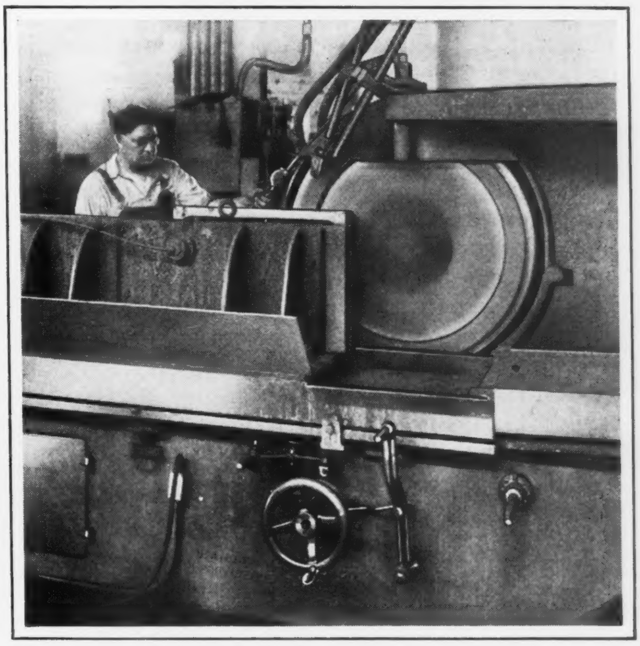
Turntable—Weight of rough casting, 4200 pounds; cost of rough casting, $336; weight in welded steel, 1740 pounds; cost, welded (includes labor, power, all material, and overhead), $105.

The total costs of the base and turntable are: For cast iron, $588; for welded steel, $174.

* * *

VERTICAL MAGNETIC CHUCK USED IN FACE GRINDING

Iron and steel parts up to approximately 7 feet long and 3 feet high can conveniently be held in a vertical position on the face grinding machine here illustrated, by employing a magnetic chuck. This machine is installed in the Schenectady plant of the



Face Grinding Machine Equipped with a Vertical Magnetic Chuck

General Electric Co., and is used for finishing a large variety of forgings and castings. The grinding wheel is 36 inches in diameter. If it is desired to place work directly on the machine table or to use a different type of work-holding fixture, the magnetic chuck can be readily removed.

* * *

SAFETY IN LIFTING HEAVY OBJECTS

Few people know how to lift a heavy object properly. The few who do rarely use their knowledge. Lifting should be done in such a way as to use the muscles of the thighs, not the back or abdominal muscles. Only by using the leg muscles can one avoid putting too great a strain on the back and abdomen.

In lifting, bend the knees, not the back, until the object to be lifted is on a level with the hands. Then straighten the knees, raising the body and the heavy object at the same time.

ALLOWANCE FOR TAP CHAMFER AND THREAD LEAD

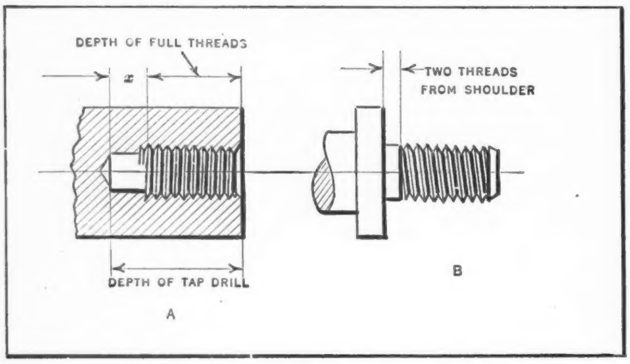
By J. K. OLSEN

Specifications for tapped holes and threaded parts, to be correct, should give the total number of full threads required. In a tapped hole, when the construction is such that it is impracticable to drill through the part and a "blind hole" is necessary, allowance should be made for the tap chamfer in drilling the hole, to insure obtaining readily the entire length of thread without using a special tap.

The depth of a tapped hole should be understood to mean the full-thread depth or, in other words, the distance a gage or screw will enter. The additional depth x (see accompanying diagram A) to allow for the tap chamfer should be equal to about four times the pitch of the thread, or the equivalent of four full threads. Thus, for a screw having 32 threads per inch, the tap drill would extend about 1/8 inch deeper than the full thread depth required. This general allowance, or additional depth equal to four threads, to provide clearance for the tap chamfer may be decreased probably to half this amount if the work is handled with extra care, but for large production, it is preferable to allow the amount specified. The accompanying table gives allowances equivalent to four times the pitch, for threads varying from 12 to 80 per inch.

The depth of a tapped hole should be based upon the assumption that a screw of maximum length is holding or clamping parts of minimum thickness, since the screw then enters the tapped hole the maximum amount. Suppose, for example, that two parts are to be clamped down by a screw; then the depth of the tapped hole should exceed slightly the amount that a screw of maximum length would extend through two parts of minimum thickness. After determining the depth on this basis, it is advisable to add at least one thread or pitch to the amount to obtain the full-thread depth in order to be on the safe side. If a stud is used instead of a screw, then the full-thread dimension should be such as to stop the stud at the desired depth.

When an external thread must end adjacent to some shoulder or projection, the thread lead allowance must be considered, since with ordinary threading equipment the full thread does not stop abruptly, but terminates with an incomplete or tapering portion. A general rule for shouldered studs and similar parts, such as are produced in screw machines, is to allow about two threads between the shoulder and the point where the full thread stops, as indicated by the illustration B. If it should be necessary, however, to reduce this clearance and extend the full thread closer to a shoulder, it is common practice to provide relief or under-cut adjacent to the shoulder. When threads are produced by the rolling process, this allowance adjacent to shoulders is not so important as in screw machine products.



Examples Illustrating Allowances for Tap Chamfer and Thread Lead

Excess Tap Drill Depth to Allow for Tap Chamfer

Threads per Inch	Pitch, Inch	Excess Depth, Inch*	Threads per Inch	Pitch, Inch	Excess Depth, Inch*
80	0.0125	3/64	28	0.0357	9/64
72	0.0138	1/16	24	0.0416	11/64
64	0.0156	1/16	20	0.0500	13/64
56	0.0178	5/64	18	0.0555	7/32
48	0.0208	5/64	16	0.0625	1/4
44	0.0227	3/32	14	0.0714	9/32
40	0.0250	3/32	13	0.0769	5/16
36	0.0277	7/64	12	0.0833	21/64
32	0.0312	1/8			

Machinery

*Excess depth to provide room for tap lead or chamfer = Pitch × 4

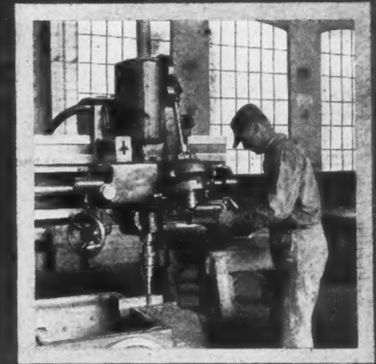
* * *

LARGEST OPTICAL FLATS IN THE WORLD

Surfaces so flat that any deviation from perfectness is too small for measurement have been produced by the United States Bureau of Standards, and henceforth will be the final word in deciding whether or not a surface really approaches flatness or straightness. The disks, or optical flats, will not be used for direct comparison but as master flats for checking the accuracy of the optical disks which are used in the work of the bureau. Accord- to the *Journal of the Franklin Institute*, measurements on the surfaces of these disks, from 10 to 11 inches in diameter and 1 to 1/2 inch thick, fail to show any places where they are more than two ten-millionths of an inch from being absolutely flat. Such accuracy means that, magnified until the disks extended from Washington to Chicago, no point except along the margin would be out of absolute flatness by more than an inch.

These flats are clear fused quartz, produced in the Thomson Research Laboratory of the General Electric Co. at Lynn, Mass. The product, commercially introduced two years ago by the company, has many properties that make it superior to optical glass. It is much harder than glass, and it expands much less than glass upon being heated. The surface of glass, formerly used for optical flats, changes considerably in shape when touched by the hand, so sensitive is it to heat. Clear, fused quartz, which expands only one-fifteenth as much as glass when heated, can be handled with greater impunity in this respect. The low coefficient of expansion of clear fused quartz also recommends its use for astronomical mirrors and for the manufacture of standards of length. Its resistance to change at high temperatures has led to its use in the manufacture of thermometers, which can be used at far higher temperatures than can be approached with glass ones. In addition to serving as a test for flatness of surfaces and straightness of edges, these standards are used in the production of standard angles and for calibrating or checking instruments that measure curvature.

Letters on Practical Subjects



COST SYSTEM FOR SMALL SHOP

A small production shop, in its efforts to find a suitable and inexpensive cost system, evolved the time card shown in the accompanying illustration. This card is simple and inexpensive to use, yet it produces the desired results.

In the system previously employed, a shop order was issued for a certain quantity of a given part, and a copy of the order was given to the foreman of each department involved in the production of the part. A separate time card was kept for each operation, the time being entered on a card by the worker who performed the operation. This is a good method in many respects, but it involves the use of too many cards, some of which may become lost before reaching the timekeeper. Such a system is, of course, too costly for the small shop.

In the present system, all the information contained on the various cards previously employed is combined on one card, as shown in the illustration. This card is kept in a heavy envelope and moves from one department to the next with the work. At the top of the card is given the usual data, such as the part name, number, and shop order. In the first column is given the worker's name and in the second column the date he was employed on the job. The third column is filled in with the part number, and the fourth column contains the name of the operation performed on the part. Following these columns are spaces for the time spent on the job each day, the total time spent by each workman, the cost, and the number of pieces received by each workman. There are also columns for noting the material required, its weight and cost.

When the shop work has been completed, the card is sent to the timekeeper, who computes the labor cost from the data on the card. The cards are then filed according to their part numbers. A summary of the material, labor, and overhead cost may then be entered in a cost ledger or on cards, and filed with the time cards.

The returned cards permit the cost of the different operations to be compared. The reason for rejecting any parts in the shop is noted on the back of the card. The type of card shown is used in a plant where from 50 to 100 parts are carried through in each lot. Each operation on a lot is generally completed in two or three days. The workmen are paid either by the hour or by a bonus system, which applies to certain parts for which piece rates have been established.

Appleton, Wis. E. H. HAGEN

Name *Blower Drive Sprocket* Shop Order No. *B 481*

Name of Machine *#75 Ensilage Cutter* Drawing Sheet No. *H 786*

Machinist Name	Date	Part No.	OPERATION OF MACHINE WORK	TIME Hrs.	TIME 10ths	TOTAL TIME	Cost of Time	Pieces Rec'd	MATERIAL REQUIRED	Weight	Cost Material
A. Jones	12-21	H 786	Turn, Bore & Face	9	—			50	Steel Casting		
" "	12-22	"	" " " "	3	2	12.2	6.10				
C. Johnson	12-22	H 786	Hob Teeth	3	4	3.4	1.36	48	50 × 6½#	325#	62.25
H. Smith	12-23	"	Broach Keyway	1	9	1.9	.76	48			
M. Kohl	12-24	"	Remove Burrs	2	1	2.1	.94	48			

Total Cost of Labor *9.16* Total Cost of Material *62.25*

Time Card for Cost System in Small Shop

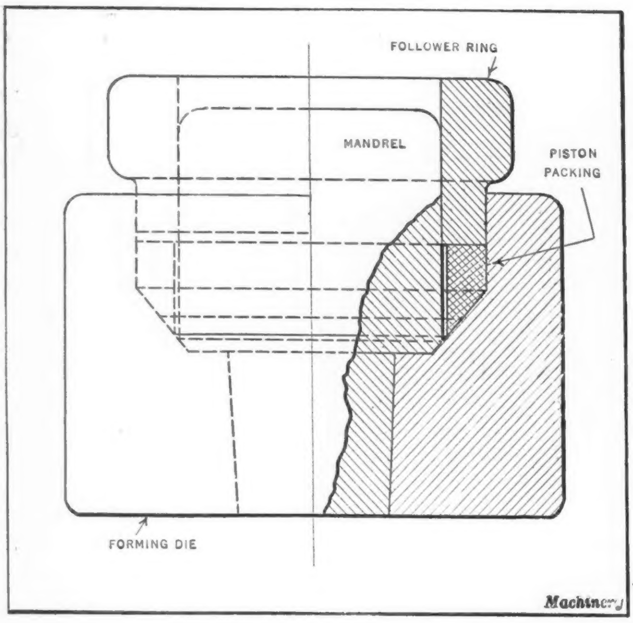


Fig. 1. Packing Reclaiming Die

RECLAIMING PISTON PACKING

Every railroad shop official knows that piston and valve stem packing for a superheated locomotive is an important item of expense. The average cost of the packing for the large size is from $2.50 to $3. Whenever a piston or valve stem is reported as "blowing" by the inspector or engine man, the old set of packing is replaced by a new set. The old packing is, therefore, scrapped, although the only trouble is that it failed to close around the rod. All of the King type of packing can be reclaimed and placed immediately back into service by using a reclaiming die like the one shown in Figs. 1 and 2.

The reclaiming die is made of a good quality of machine steel and is casehardened. The forming dies are made in different sizes to suit the different sizes of packing to be reclaimed. Assuming, for instance, that packing for a 4 1/4-inch piston-rod is to be reclaimed, a die follower ring and mandrel of the dimensions shown in Fig. 2 would be used.

The packing may be worn 1/16 inch larger than the rod or, in other words, it may have a bore diameter of 4 5/16 inches. In this case, we select a mandrel 1/16 inch smaller than the size of the rod, or 4 3/16 inches in diameter. The tapered end of this mandrel is inserted in the tapered hole in the die at *A*. The packing to be reclaimed is placed in the die shown in Fig. 1, after which the follower ring is placed on top of the packing and forced down by hydraulic pressure or by one or two blows under the steam hammer. This operation closes the packing in around the arbor or mandrel, making the bore 1/16 inch smaller than the piston-rod. The segments of the packing are also reshaped by the operation.

The piston-rod is then calipered, and the packing placed in a special chuck and bored out to fit the rod. The packing thus reclaimed will withstand as much service as a new set. Three or four sizes of follower rings and mandrels are required to accommodate the various sizes of piston-rods as they gradually wear down. The packing reclaiming die can be made at a comparatively low cost and will last indefinitely. It is estimated that the packing cost in our shop has been reduced 75 per cent by the use of reclaiming dies like the one described in the foregoing.

Chattanooga, Tenn. H. H. HENSON

CUTTING-OFF, PIERCING AND NOTCHING DIE

A die for cutting off, piercing, and notching flat band iron, 1/8 inch thick and 7/8 inch wide, is shown in the accompanying illustration. The stock is required to be cut off to various lengths, with rounded ends and pierced holes which must be a given distance from the ends. In addition, some of the bars must be notched.

In starting a strip of band iron *A*, it must be operated on once by punch *E*, which rounds the end, as shown at *X*, and pierces the hole *G*. For this operation, the strip is fed in just far enough to permit the punch *E* to round the end. After this has been done, the strip is fed through to the

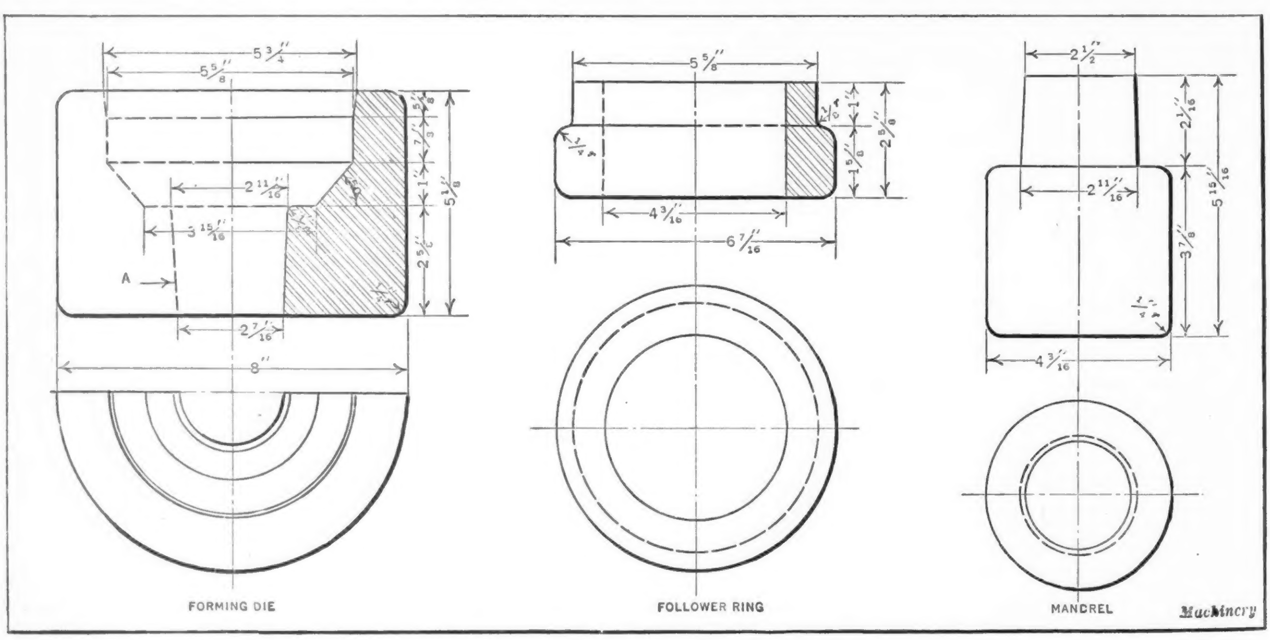
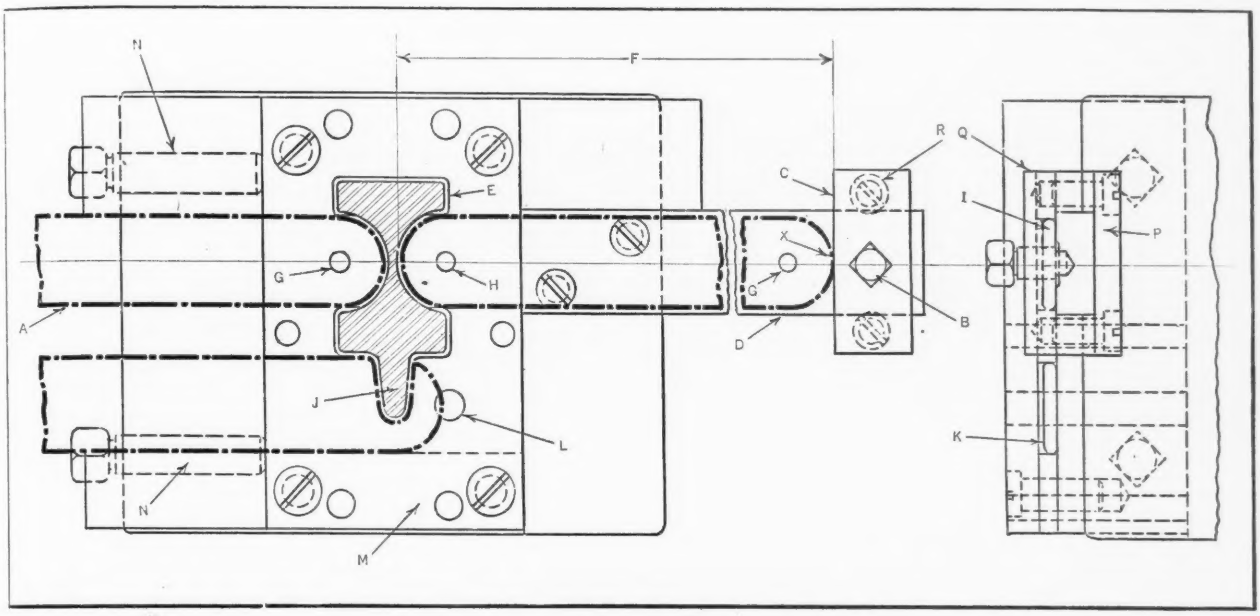


Fig. 2. Details of Packing Reclaiming Die



Die for Piercing, Notching and Cutting off Band Iron

full length F against the stop C. Punch E then cuts through the bar of stock, leaving both ends rounded, and at the same time, the two small holes G and H are pierced in the usual manner. The stock is fed under a stripper plate at I, and the scrap pieces pass out through an opening in the die.

On most of the work this is all that is required, but as quite a number of bars must also be notched, the punch E is made with a tongue-shaped piece at J which notches the work when it is put in place under the stripper plate at K, where it is located against the pin L. Thus one punch, having a double radius section and a slot-notching projection, in combination with the die member, does all the work necessary on the bar. The punch is held to the arm of the press in any suitable manner, while the die-block M, having the stripper plate mounted on its outer surface, is held in the die bed by means of screws N.

The gage-block C is made in two sections, a plate P being attached to a sliding block Q by means of screws R, so that it is a sliding fit on the bar D and can be clamped in any position by screw B. In the particular die shown in the illustration, however, the screw B has its end turned down so that it will enter any one of the series of holes on bar D, which are properly located for gaging the distance of the different lengths of bars required.

H. M.

TOOL FOR RETAPPING THREADS

It is sometimes necessary to retap a hole in order to clear away matter deposited during the finishing operations. Retapping is generally done by hand in the assembly shops. If the thread happens to be of fine pitch, considerable trouble may be experienced in picking it up, and in fact, quite a number of parts are spoiled through the stripping of the threads. Trouble of this kind was experienced in retapping holes in a small casting. After some experimenting, a special tap for retapping the fine threads in these holes was evolved which minimized the trouble.

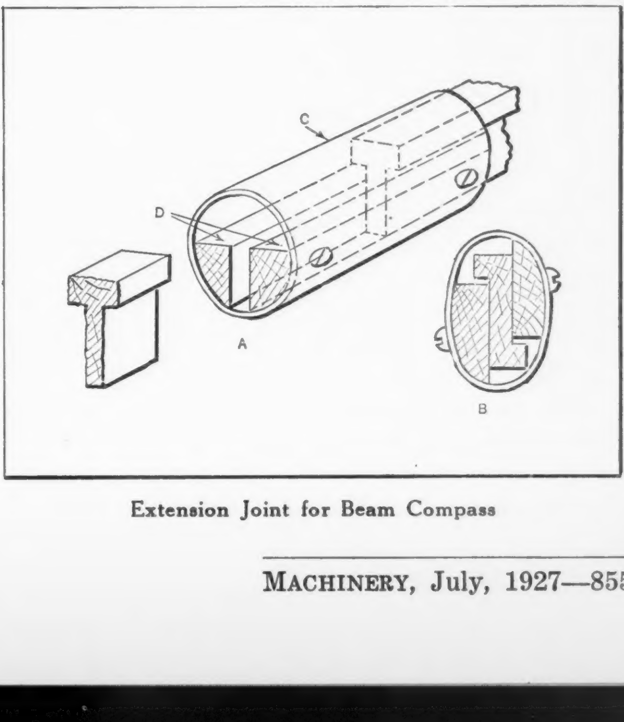
The special tap was made in the tool-room, the thread being cut to a constant depth but with an effective diameter which tapered to the start or point of the tap. In effect, it was a tap with a leading end having full threads its full length. With taps of this kind no difficulty was experienced in picking up the finest of threads used for optical goods. Flutes were cut in the tap, but they served more as dirt grooves than as a means of giving the tap cutting edges. In fact, the grooves were so designed that the threads had a rubbing rather than a cutting action.

London, England — A. L. WALKER

EXTENSION FOR BEAM COMPASS

One of the most cumbersome pieces of equipment employed by the draftsman is the wooden lath on which the heads of beam compasses are mounted. The trouble experienced in transporting this piece of equipment often causes the draftsman to leave it behind and count on the chance of finding a substitute at his destination. In many cases, however, it is difficult to find a suitable piece on which to mount the beam heads.

To overcome this trouble, the writer made up a portable beam outfit from a 36-inch lath of T-section cut into three pieces, 12 inches long, and fitted



Extension Joint for Beam Compass

with joints like the one shown at *A* in the illustration. The short lengths of the extension bar can be readily packed in a case with the drafting scales. The steel tubes *C*, which are used to join the sections of the beam, are made from bicycle tubing 1 inch in diameter by 2 1/2 inches long.

Referring to the illustration, it will be noted that blocks of hard wood *D*, the same length as the tube, are secured in place within the wall of the tube by means of wood screws. The ends of the laths or beams are rounded to facilitate their entry in the joint, and they are forced inward until they meet in the middle of the tube. This forms a rigid joint, but one that can be readily separated. By providing a number of lath sections and several tube joints such as shown, the beam can be built up to any desired length. While in this particular case a T-section beam or lath was used, a similar construction employing a Z-section beam, as shown in the view at *B*, can be employed with a tube of flat or oval section. The round tube is also suitable for the Z-section, but the oval tube is not suitable for the T-section.

Auburn, N. Y. WALTER S. BROWN

HEIGHT GAGE ATTACHMENT FOR SCALE

In Figs. 1 and 2 are shown a 12-inch machinist's scale with an attachment for use in transferring scale measurements to the work. Any make of scale can be used that has a slot in the center. A 2-foot scale will be found very convenient when equipped with this attachment. The attachment consists of the base *A*, Fig. 1, and the sliding attachment *B*. The edges *C* of slide *B* are made sharp, to permit a line on the scale to be easily split. These edges lie in the same plane as the flattened surface of the scriber *E*.

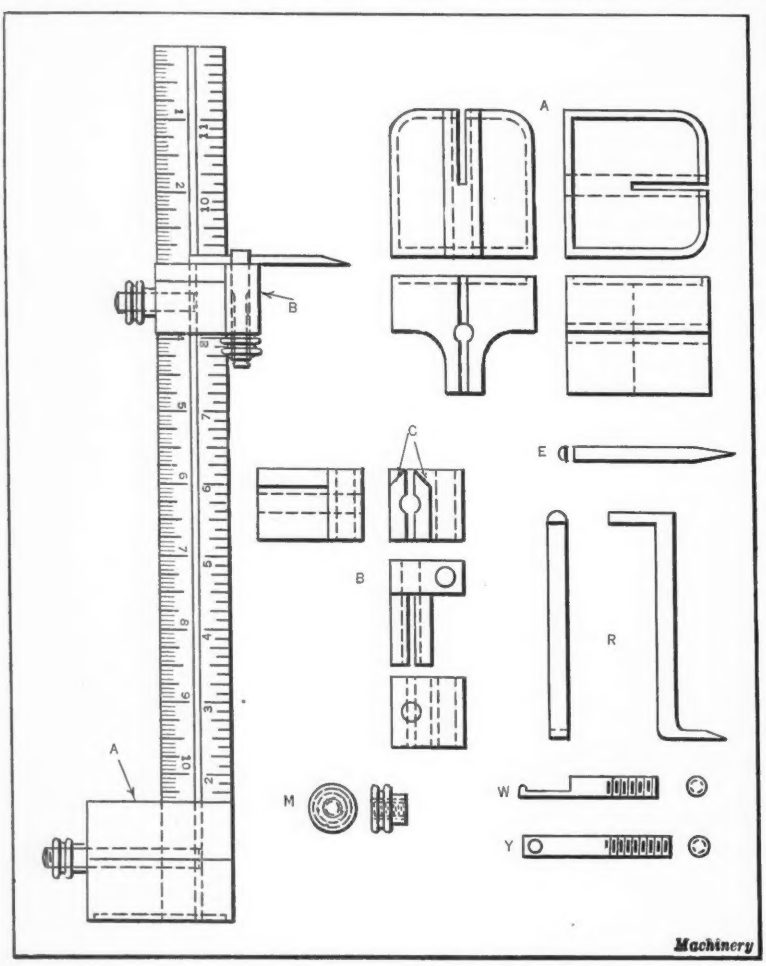


Fig. 1. Details of Height Gage Attachment for Machinist's Scale

The bent scriber *R* is used to scribe lines from the base upward. At *M* and *W* are shown the nut and screw, respectively, that are used to clamp the base *A* and part *B* to the scale. Scriber *E* is clamped by piece *Y* and nut *M*.

CHARLES KUGLER
Philadelphia, Pa.

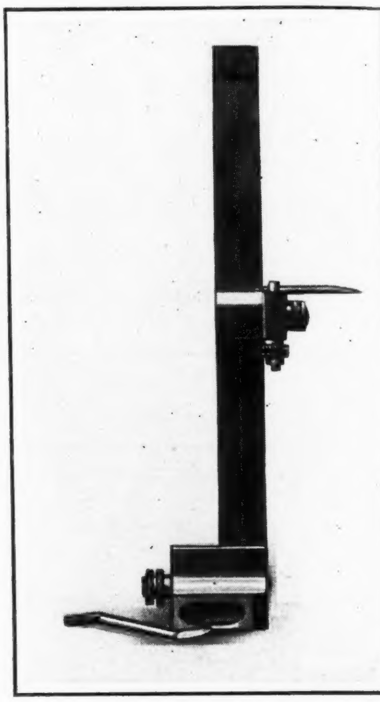


Fig. 2. Machinist's Scale Equipped with Height Gage Scriber

JIG FOR DRILLING HOLES AT AN ANGLE

In designing jigs for use in drilling holes that must be at an angle with the surface of the work, it is well to make provision for a slip bushing, so that a spotting or centering drill of a size large enough to avoid danger of bending can be used for starting the hole. The larger drill will also form a chamfer for the smaller hole.

When the bushing for the small drill is inserted, the drill will be lined up with the spot and the cutting action at the start will be the same as on a flat surface. The end of the bushing for the small drill should be tapered to fit the chamfer left by the large drill. This method of starting the drill on an angular surface eliminates drill breakage.

JAMES MCINTOSH
Cleveland Heights, Ohio

TAPPING ANGLE-PIECES

The fixture here illustrated is employed on a standard horizontal tapping machine for tapping the holes in the angle-piece shown at *A*. This piece, which is made of brass, is part of an electric switch, and has one hole threaded for an 8–32 screw, and the other hole tapped for a 10–32 screw. It will be noted that the tapped holes are at right angles to each other, and for this reason, two separate tapping operations would ordinarily be required. With the fixture shown, however, one piece is finished at each feeding movement of the work-holding turret *T*.

When the fixture is in use, the operator is seated at the rear of the ball handle *B*, facing the ends of the taps. The pieces to be tapped are piled on a

tray (not shown in the illustration) at the left-hand side of the fixture. The ball handle B is grasped with the right hand, and a piece of work placed in the turret with the left hand. By pushing the ball handle B forward, the work held in the turret is advanced to the taps C and E. The larger tap C taps the longer end of the angle-piece D, while the smaller tap E taps the hole in the short end of another piece F. As the pawl G comes in contact with the finger H, the end of the latter member moves downward and ejects the piece already tapped, which falls into a receptacle placed under the fixture. After making contact with the pawl G, the finger H is returned to its former position by the spring J.

When the work has been fed on the taps a sufficient distance, the machine is reversed and the turret drawn back until the indexing pin K is withdrawn from the hole in the spacing dial L. The ball handle B is then given a quarter turn. As the gear N on shaft P has the same number of teeth as the gear M on the turret arbor Q, the latter member will also be revolved a quarter turn, bringing piece D into the position previously occupied by piece F, and piece R into the position previously occupied by piece D. Then the ball handle B is again pushed forward, and the cycle of operations described is repeated. The pin K, entering the properly spaced holes in plate L, serves to hold the work in the proper position while tapping.

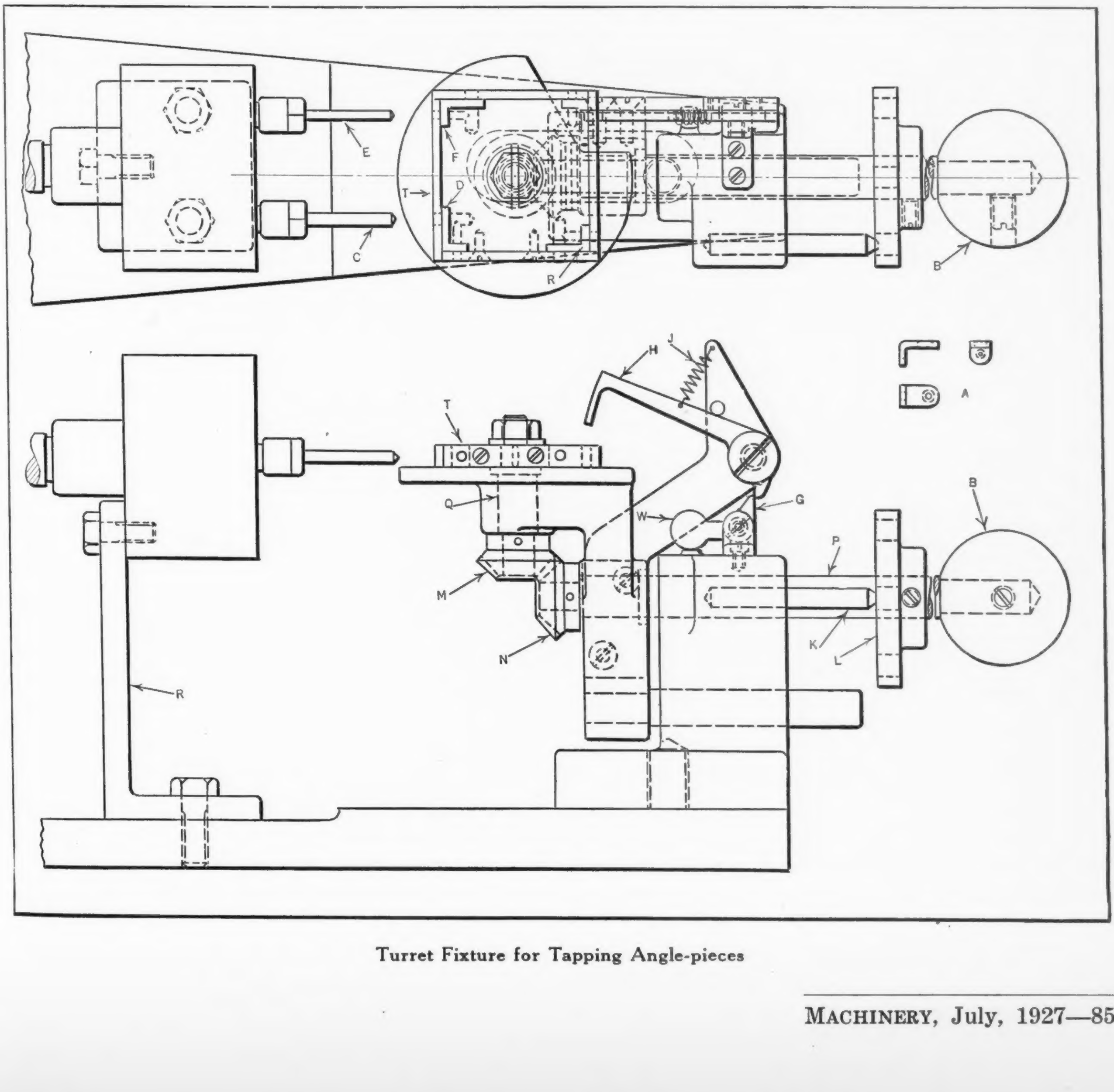
The tapping head is constructed along the same lines as the ordinary standard multiple-spindle drill head. The tapping machine spindle furnishes the drive for rotating the taps. The bracket R provides a rigid support for the tapping head and also keeps the latter member from turning. The base of the turret-supporting member is cut away at the back to permit the work to be ejected by the finger H. It will be noted that the pawl G is pivoted on a small bracket secured to the base of the fixture and that it has a weighted end W which causes it to turn to the position shown after being tripped on the return movement of the slide.

Bridgeport, Conn. J. E. FENNO

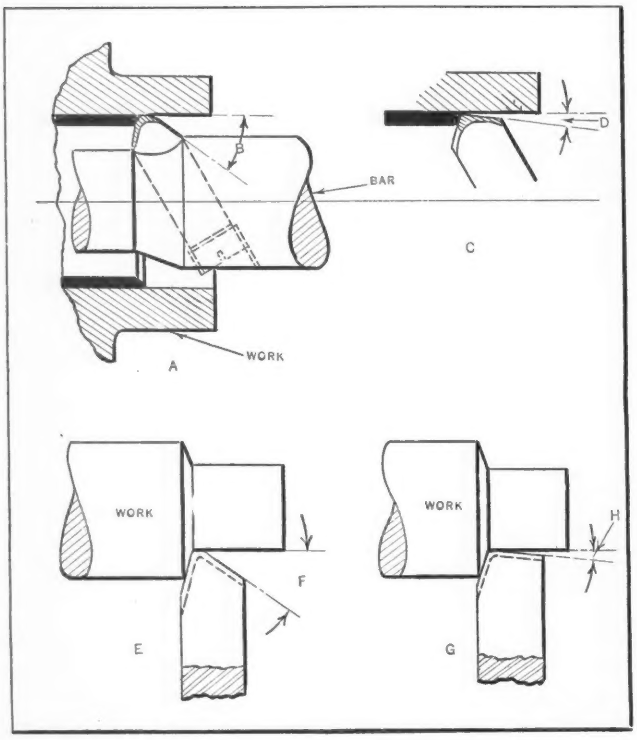
CORRECT GRINDING LENGTHENS TOOL LIFE

How often you hear a man in the shop say, "That tool doesn't stand up worth a cent," and then follow up the remark by removing the tool and regrinding it for perhaps the fourth or fifth time that day. It is seldom that the man considers whether or not it is the shape of the tool itself that is causing the trouble. Originally it may or may not have been made correctly, but certainly after Tom, Dick, or Harry have all had a try at it, it is hard to tell what the first form was like.

All tools become more or less warm from the pressure and friction of the cut, and although high-speed steel tools will stand more abuse than car-



Turret Fixture for Tapping Angle-pieces



Correct and Incorrect Methods of Grinding Boring and Turning Tools

bon steel tools, it is not advisable to think of them as indestructible. The greatest heat is developed at the point of the tool, and the keener or finer the point, the less heat it will stand before breaking down.

A few days ago I went through a factory where considerable boring was being done on engine lathes and turret lathes. Most of the boring tools were ground as shown at *A*, with the clearance angle *B* sometimes as much as 30 or 35 degrees. The tools naturally were not standing up well, particularly when boring cast iron. The suggestion was made that the tools should be ground as at *C* with the angle of clearance *D* from 5 to 8 degrees. This form obviously gives a greater section to carry away the heat, so that the tools stand up much longer.

The same thing applies to turning tools, for very often we find them ground as at *E* with a clearance angle *F* as great as 45 degrees. Here also the remedy is obvious, for tools ground as at *G* with a clearance *H* of 5 degrees, or a little more, will stand up much longer and give better service.

Detroit, Mich. ALBERT A. DOWD

SMALL PRESS FOR BURR-SHAVING DIE

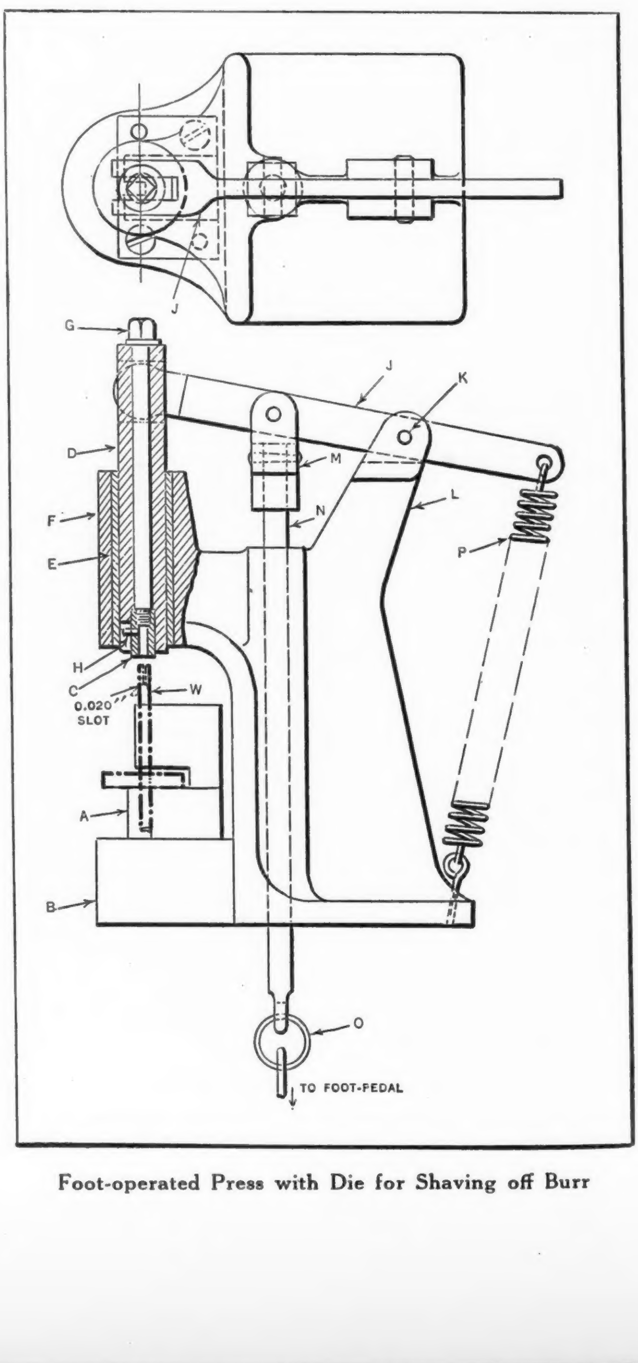
The article entitled "How Your Radio Set is Built" on page 401 of February MACHINERY proved very interesting to me. I was particularly struck by the tiny wire-bending press shown in one of the illustrations. This reminded me of a very small press that I once saw, which had some other interesting features besides its small size. This press, which stood about 6 inches high over-all, is shown in the accompanying illustration.

The job to be done consists of shaving off the burrs raised by cutting a 0.020-inch slot in the top of the brass gear shaft shown in dot-and-dash lines at *W*. This shaft and the gear are assembled, after which the assembled unit is placed in the nest *A* on the foot of the frame *B*. The shaving die *C* is contained in spindle *D*, which moves up and down in brass bushing *E* in head *F* of the frame.

As the shaving die must be kept sharp, frequent grinding and renewal are necessary. The die is, therefore, made easily removable, being retained in its seat in the spindle by the draw-rod *G* which, being screwed down into the thread in the shaving die as shown, clamps it in place. The pin *H*, driven into the die bushing, fits a slot cut in the spindle and thus prevents the die from being rotated when the draw-rod is turned. Several dies *C* are kept in stock, so there is no delay in renewing them.

Fitting the top of the spindle is the yoke at the end of lever *J*, which is pivoted on the pin *K* in the bracket *L* of the frame. Attached to this lever is a yoke *M*, which is pinned to the rod *N*, which, in turn, passes through the frame. A chain *O* connects this rod to a foot-treadle which, on being pushed down by the operator, causes the lever *J* to force down the spindle *D*. The die *C*, being thus forced over the work, shaves the burrs from the edges of the slot. Releasing the foot-pedal allows the spring *P* to act on lever *J*, which raises the die so that another piece can be placed in the nest.

New York City B. J. STERN

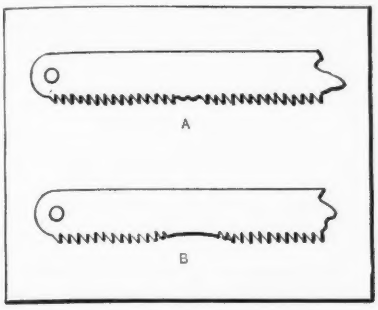


Foot-operated Press with Die for Shaving off Burr

Shop and Drafting-room Kinks

PREVENTING HACKSAW BREAKAGE

It is not unusual, when a power or hand hacksaw is being used, to have one or two of the teeth break out, as indicated in the view at *A* in the illustration. This often happens long before the saw shows signs of becoming dull or worn out, and is more likely to occur when tubing or metal having a thin section is being cut. When teeth are broken out in this way, the saw catches, and the gap is quickly enlarged by the breaking out of more teeth. This can be prevented and the life of the saw prolonged if the saw is removed from the frame or machine and the full teeth at the end of the gap ground down, as indicated in the view at *B*. This gives a gradual rise and fall to the blade as it passes over the work and prevents the teeth from catching. The same kink can also be used to advantage on circular saws.

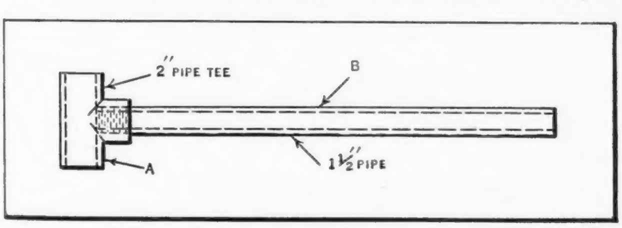


Teeth of Hacksaw Blade Ground down to Prevent Breakage

London, England — ROBERT JULIAN

HANDY PIPE-BENDING TOOL

A pipe-bending tool which will be found to be a useful addition to the tool equipment of pipe-fitters and electricians is shown in the accompanying illustration. The tool consists of a steel or wrought-



Tool for Bending Pipe

iron tee *A* fitted with a handle *B*. The handle *B* is simply a piece of pipe, threaded at one end and screwed into the tee as shown. When a piece of pipe is to be bent, it is placed in the bench vise and the tee placed over the pipe at the point where the bend is to be made. By pressing down on the end of handle *B*, the pipe can be bent to the angle desired.

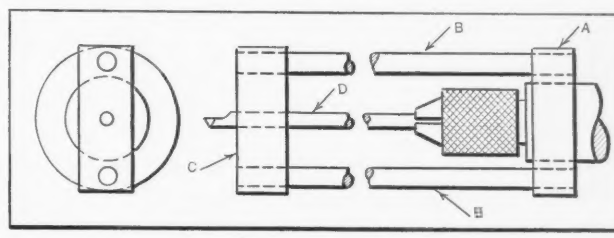
Denver, Col. — R. M. THOMAS

TAILSTOCK SUPPORT FOR DEEP-HOLE DRILL

A workman in an eastern machine shop recently devised an interesting attachment for boring deep holes of small diameter in a lathe. The work consisted of boring an odd sized hole, as accurately as possible, through the center of a piece turned on the outside at the same chucking. As only a slender boring tool could be used, it was difficult to produce a straight hole. By holding the boring tool in the tailstock, however, it was possible to use a stronger tool.

The device, as shown in the accompanying illustration, supports the tool rigidly at the beginning of the cut, when it is most likely to be deflected. The collar *A* is fitted to the tailstock spindle, and the two rods *B* are driven into the collar. The piece *C* is driven on the other end of the rods *B*. When assembled, the hole for the boring-bar *D* is drilled and reamed.

In operation, the collar *A* is slipped on the spindle and the boring-bar *D* gripped in the chuck and



Tailstock Support for Drill

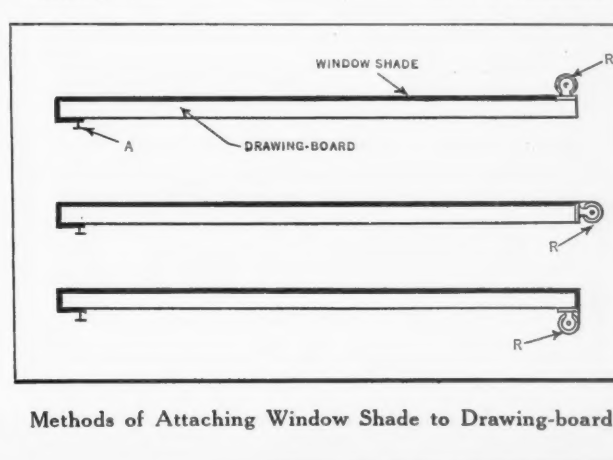
fed through the hole by advancing the tailstock spindle. The crosswise adjustment of the tailstock, provided for use in turning tapers, is employed to adjust the tool for the required depth of cut. Obviously the method described cannot be used on a lathe having a fixed tailstock.

Rosemount, Montreal, Canada — H. MOORE

COVER FOR DRAWING-BOARD

An ordinary window shade, with the roller attached to one end of the drawing table in one of the three positions *R*, shown in the accompanying illustration, makes a very good cover for the table. This type of cover protects drawings left on the board and can be quickly rolled up out of the way or pulled down so that it covers the board. The hook on the shade can be looped over a tack *A* in the drawing-board to hold the shade in place when drawn down.

Leeds, Ala. — R. W. GAMBLE

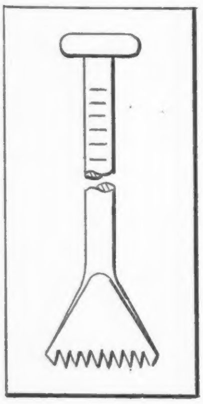


Methods of Attaching Window Shade to Drawing-board

Questions and Answers

CLEANING FILES

T. F. J.—The writer has experienced considerable annoyance by the clogging up of file teeth with soft metal. The wire file card, although very satisfactory in some cases, will not always remove the clogged metal. In such instances, the use of a scratch awl is resorted to, but removing the metal with this tool is a tedious job. Will some reader please suggest a simple but more effective method of cleaning files?



File Tooth Cleaner Made from Wire Nail

Answered by C. A. Martyn
Lewisburg, Pa.

Most files become clogged very quickly when used on soft metals such as brass. Often a good file is discarded as worn out when really all it needs is cleaning. Many mechanics seem to think that a little brushing with a wire brush is all that is required, but upon close examination it will be found that a brush does not always remove the filings, which are wedged tightly between the teeth of the file. A simple and more efficient file cleaner for some purposes is shown in the accompanying illustration. This cleaner can be made in a few moments from an eight- or ten-penny wire nail.

To make a cleaner like the one shown, simply hammer the point of the nail down on the anvil to a sharp wedge-shaped edge. This edge is then drawn across the file several times, causing teeth to be cut in the flattened end as shown. These teeth fit the contours of the file teeth and clean them of all accumulations. A file cleaner of this kind is novel in that it is self-sharpening and cleans several teeth at once.

Under a microscope it will be seen that file teeth are covered with minute irregularities which, when filing babbitt, copper, or similar metals, will become "loaded" and thus destroy the cutting action of the file. Files in this condition can be improved somewhat by the use of a solvent or acid or by exposing them to the flame of a blow-torch for a few moments. Care must be taken, however, when employing the latter method not to allow the file to become too hot. Several cleaners like the one shown in the illustration, on which teeth have not been formed, may be placed in the tool-box for future use.

Answered by John Homewood, Ontario, Cal.

Occasionally one reads of some unique method of cleaning files. Files do need a cleaning once in a while, but if as much care is employed in handling them as in feeding the lathe or other machine tool, there will be less annoyance from clogging. The teeth on a file will clear only a certain amount of material, and if too much pressure is employed, the clearing capacity of the file is exceeded and the teeth become clogged. This clogging not only mars the work, but also necessitates cleaning the file with one of the special appliances devised for the purpose. To use files effectively, one must employ the same consideration as would be accorded any other tool. Do not try to overload them beyond their cleaning capacity.

EMPLOYER'S LIABILITY WHEN MINOR IS GIVEN A DIFFERENT JOB

H. A. J.—When a minor is employed with the parents' consent, is the employer's liability affected if the minor is changed to different work without notification to the parent?

Answered by Leo T. Parker, Attorney at Law,
Cincinnati, Ohio

The general rule of the law is that a parent who permits a minor to obtain employment may stipulate the kind of work to be performed. But the consent of a parent for a minor to be employed at one particular kind of labor must not be construed by an employer to represent an agreement whereby the employer is permitted to place the minor at more dangerous work.

Ordinarily, so long as the minor is hired with the parents' consent and is retained at the same kind of work, the employer's liability for damages as a result of injuries sustained is the same as when an adult is injured. However, if the child is changed to more dangerous work without the consent of the parents, the employer's liability is decidedly affected. For example, in a case which involved this point, the Court held that an employer who orders a minor to work at a more dangerous occupation, without obtaining the consent of the parent, is liable for damages whether or not the injury is sustained through fault of the minor.

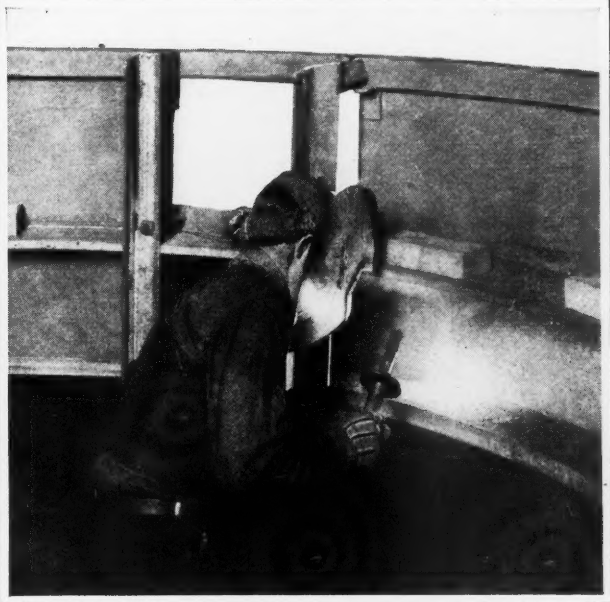
In another case where a minor was employed with the consent of his parent as a helper on a molding machine, the boy was directed to adjust belts on dangerous machinery and was injured while attempting to do so; the Court said, in effect, that the work at a molding machine is so different in character from that of adjusting belts that the employer was liable for the injury sustained. The Court explained, further, that the father had the right to presume when he agreed to permit his son to work as a molder's helper that the employer would not expose him to increased danger.

On the other hand, when a minor is hired by the consent of a parent to do specific work and the employer changes the minor to another occupation which is not more hazardous than the agreed work, the employer is no more liable for damages than if the employe remained at the occupation known to the parent. Hence, the decision in such cases depends mainly upon whether or not the work in which injury was sustained is deemed more dangerous than the work originally performed.

Welded Parts Take the Place of Castings

Fabrication of Plates and Structural Shapes into Machine Members by Arc Welding

By CHARLES O. HERB



WITHIN the last few years revolutionary changes have been made by the General Electric Co., Schenectady, N. Y., in the construction of large electrical apparatus and of smaller machines, especially when only one or a few are required. Whereas castings were previously used to a large extent for building equipment of these classifications, they have now been almost entirely displaced by members made up by arc-welding steel plates, slabs, and structural shapes together. In walking through the shops of this company, one may see a heavy 6500-horsepower motor, a converter of 14,000 kilowatts, or a 50,000-kilowatt generator for a hydro-electric plant, all being assembled with hardly a casting in sight. Housings, bases, pedestals, and similar parts are generally of welded construction.

Advantages Derived by the Elimination of Castings

Many advantages are claimed for the new construction, one of the most important of which is the time element. When castings were used, special drawings for the pattern shop were necessary and patterns and core-boxes had to be made before the castings could be poured. Then, too, an annealing process was always required with castings of complex design, and the time involved in getting castings to the machine shops was the deciding factor in specifying the completion date for equipment. Today, the fabricated units are delivered to the machine shops in less time than was formerly consumed in making the patterns. Completion dates depend upon the time required for producing the strictly electrical parts, and consequently, there is a large saving of time.

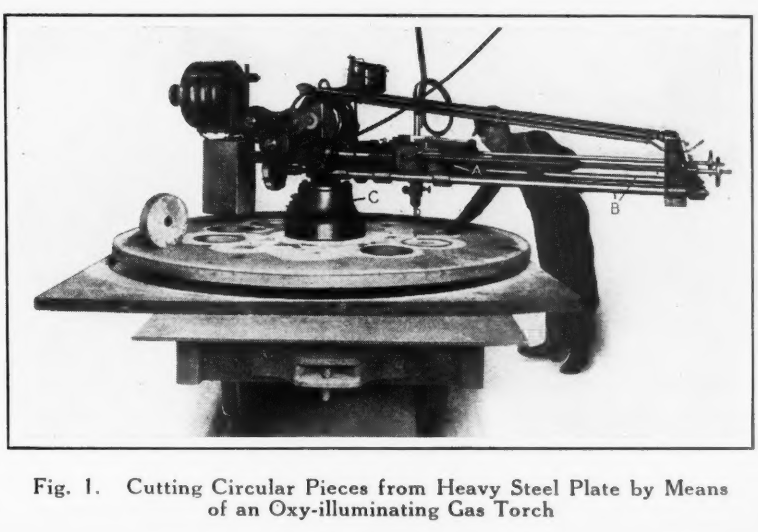


Fig. 1. Cutting Circular Pieces from Heavy Steel Plate by Means of an Oxy-illuminating Gas Torch

Strength is another advantage of prime importance claimed for fabricated members. With castings, there may be serious faults that are not found until a considerable amount of machine work has been done. Then the casting must be scrapped and another one ordered from the foundry. Sometimes internal blow-holes or other defects are so completely covered by surrounding metal that they remain undiscovered until the part fails in service.

The mild steel plates, sheets, etc., used in the fabrication method are far more uniform in quality, and although high factors of safety are used in designing the parts, much lighter sections of metal can be specified than with castings. A case in point would be a cover, say 30 feet in diameter, for some large apparatus. If this cover were cast, the metal would probably have to be from 3/4 to 1 1/2 inches thick, whereas steel sheets from 1/8 to 1/4 inch thick can be welded together and will make a cover fully as satisfactory in appearance and of much less weight.

There were formerly many instances where the impossibility of casting long thin sections made it necessary to use excessively heavy castings for light-duty work. The much lighter fabricated members are more easily handled by the shop, and the shipping costs are less. The smaller amount of metal also reduces the machining time on surfaces that must be accurately finished.

Fabricated members cost less than castings, because pattern-shop, core-shop, and foundry work are eliminated, and large amounts of floor space that would be required for pattern storage can be used for profit-paying purposes.

From the standpoint of the designer, one particular advantage of fabricated parts is that changes in their construction, which may be found desirable during the building or assembly stages, can easily be made by welding new pieces in

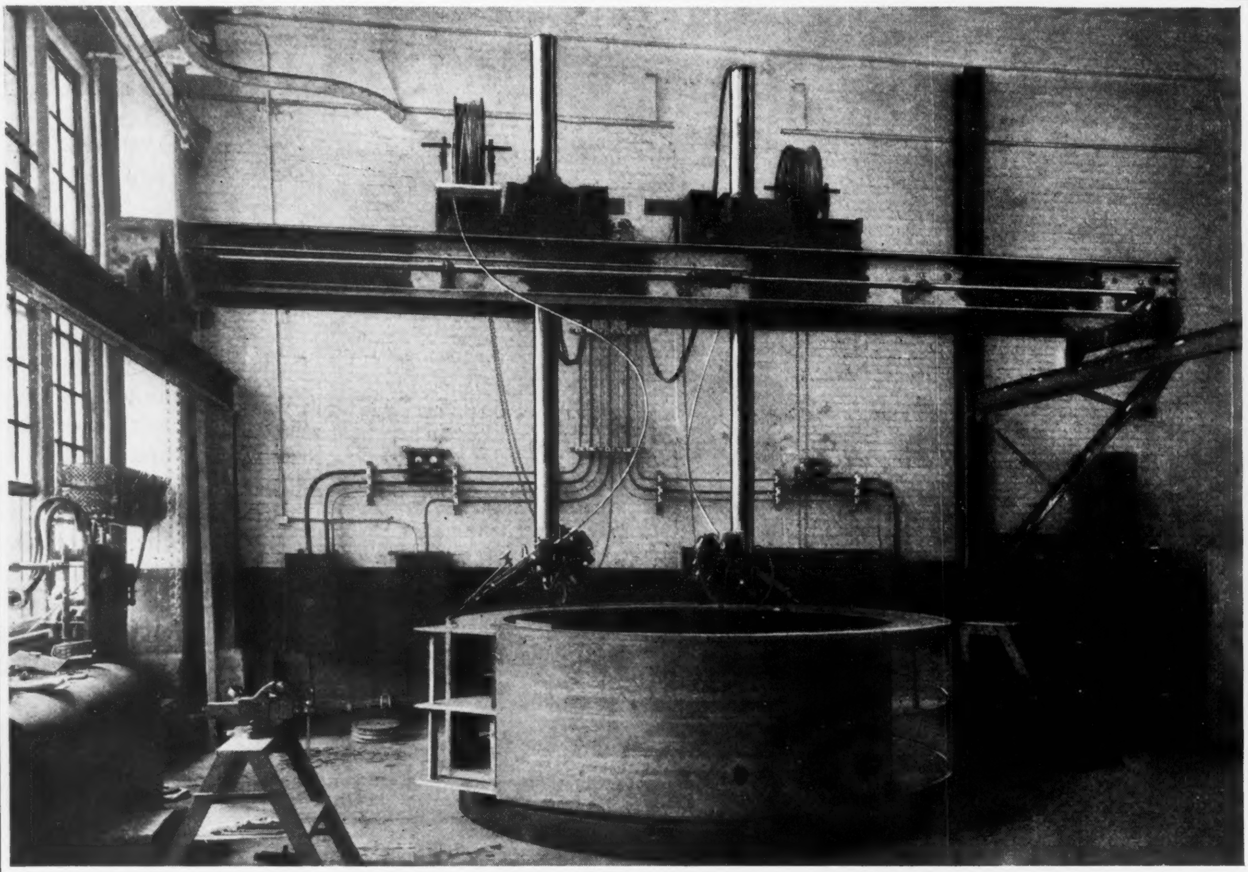


Fig. 2. Welding Machine Provided with a Table which Revolves the Work Past Two Automatic Heads for Welding Along Circular Seams

place or by cutting out openings, etc. Rolled steel, such as is used in the fabrication, can be machined at a uniform rate of feed and speed, which is not possible when hard spots occur in castings. Fillets formed by the welding material in joining two pieces of steel together can be covered with a filler and painted over to give an appearance that compares favorably with any casting.

Steel Pieces are Cut by the Oxy-illuminating Gas Method

Oxy-illuminating gas torches are used for cutting plates to the desired outline and bars or structural shapes to length. Plates from 3/16 inch to 8 inches thick are cut smooth by this method within plus or minus 1/32 inch. Plates 1/2 inch thick can be cut at the rate of 15 inches per minute, 1-inch plates at 10 1/2 inches per minute, and 2-inch plates at 7 1/2 inches per minute. Light angle-irons are usually punched to length, a punching rather than a shearing machine being employed so as to obtain clean sharp ends that may be conveniently welded.

Machines of the type illustrated in Fig. 1 are generally employed for cutting plates to circular or irregular outlines. These machines are self-contained units which can be picked up by an overhead crane and placed directly on the plate to be cut. The cutting torch is held on an adjustable slide mounted on head *A*, which can be swiveled on its own axis. By placing the torch slide in various positions on the head and then revolving the head about its own axis, small rings or disks can be cut automatically to the desired diameter. Fig. 1 shows an operation in which a large disk, about 6 feet in diameter, has been cut from a plate about 2 inches thick, and 12-inch disks are being cut from the large disk. It is never necessary to clamp the work for cutting operations.

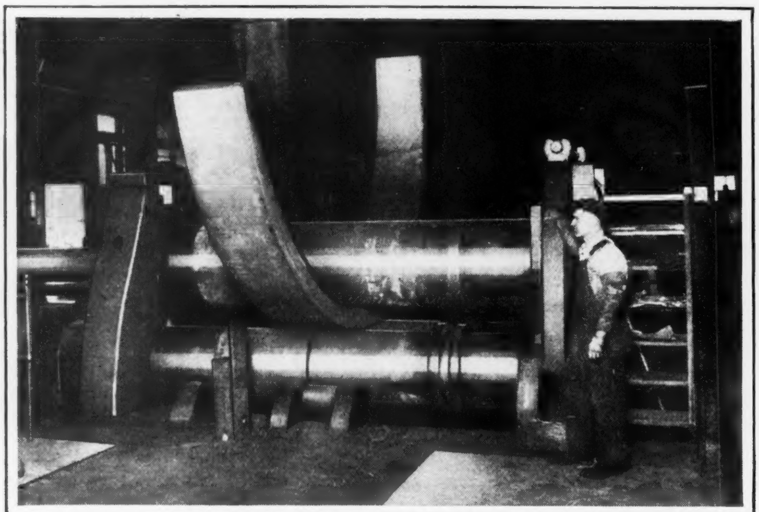


Fig. 3. Rolling a Heavy Slab to Form a Motor Stator Frame

Large rings or disks can be produced by swinging bars *B*, on which head *A* is mounted, completely around base *C* of the machine, either automatically or manually. Two torches can be employed at one time for cutting the inside and outside of rings simultaneously. Radial and irregular lines can be produced by moving head *A* in and out on supporting bars *B*.

Machines of the same type mounted

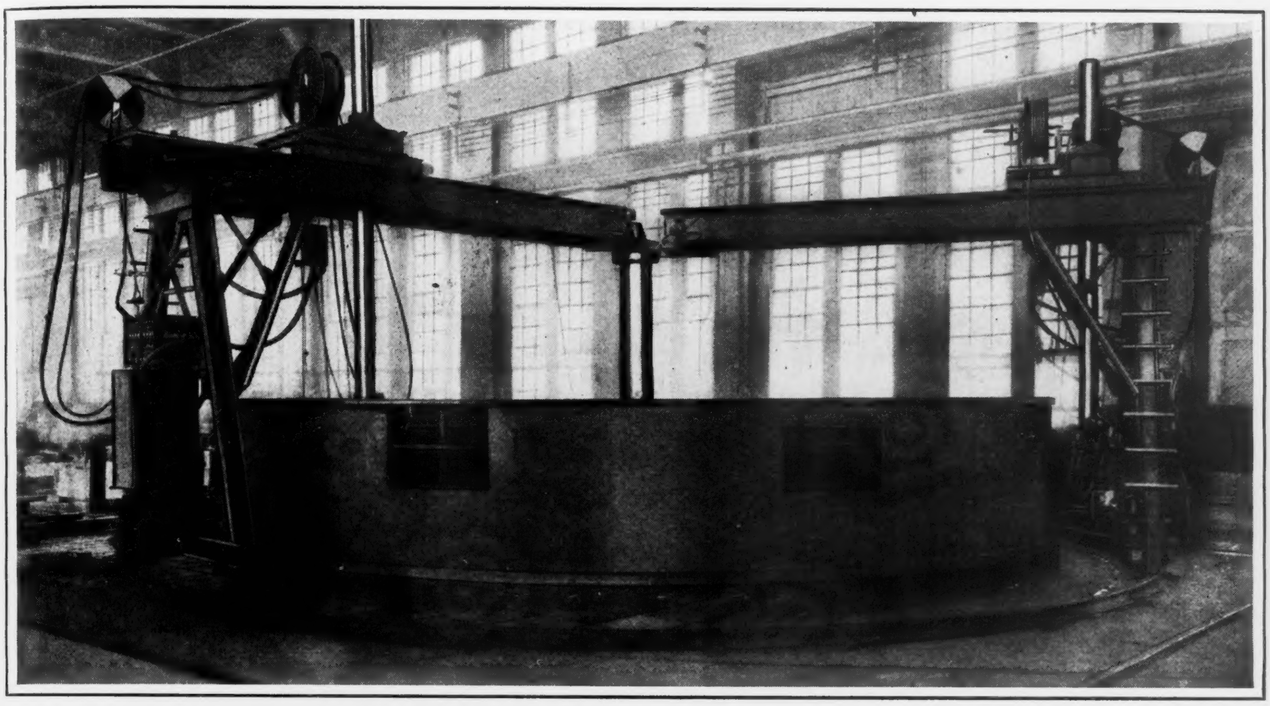


Fig. 4. Another Automatic Welding Machine in which Two Welding Heads can be Moved Around Work up to 40 Feet in Diameter

on carriages that move on the ways of a long bed are employed for cutting square, rectangular, and irregular pieces. For performing such operations in quantity automatically, pantograph devices are employed.

Hot-rolling Pieces

Heavy bending rolls are used for shaping the steel slabs, bars, and plates to various radii. The upper roll of the machine illustrated in Fig. 3 weighs 72 tons, and has rolled plates hot up to 8 1/2 inches thick by 40 inches wide. Plates up to 8 by 2 inches can be rolled edgewise. When heavy slabs are to be rolled into frames for direct-current motors and generators or synchronous converters, the ends of the slabs are first cut to fit together. The machine then rolls the piece until the ends closely fit each other. Later the two ends are welded together.

Prior to a bending operation, the material is heated to a bright red all the way through in a specially constructed car-type furnace. The heating chamber above the level of the car is 48 inches square by 30 feet long.

How the Parts are Welded

Automatic machines are employed for welding straight or circular seams of sufficient length to warrant their use, while hand welding is employed for fittings and short seams. Metallic arc welding is employed throughout. In making up stator frames of the construction shown in Figs. 2 and 4, it has been found desirable to construct the large inner rings from several pieces of the proper radius. These pieces are clamped to smooth cast-iron floor plates, and are then welded together by the hydrogen-enveloped arc process, which gives a strong ductile weld by the prevention of oxidation. When all the pieces have been joined together on one side, the entire ring is turned over and the opposite side completed.

Plates up to 2 inches thick are welded by this process without beveling the edges that are joined together. The cast-iron floor plates have T-slots running at right angles to each other so that clamping bolts can be conveniently used. Floor plates for light work are provided with tapped holes to receive clamping members.

Rings for stator frames up to 14 feet in diameter are brought to the machine illustrated in Fig. 2 for welding the various rings to enclose "wrapper" plates. One of the rings is first placed on the machine table, after which angle-irons of the proper height are "tack welded" vertically on it for spacing purposes. Then, the uppermost ring is laid on the angle-iron spacers and is "tack welded" to them. The cold-rolled wrapper plate is next placed around the two horizontal rings and after being "tack welded" to them, is completely welded. This is accomplished automatically by revolving the machine table to carry the work past the two welding heads. During the operation, the welding metal is fed automatically to the work.

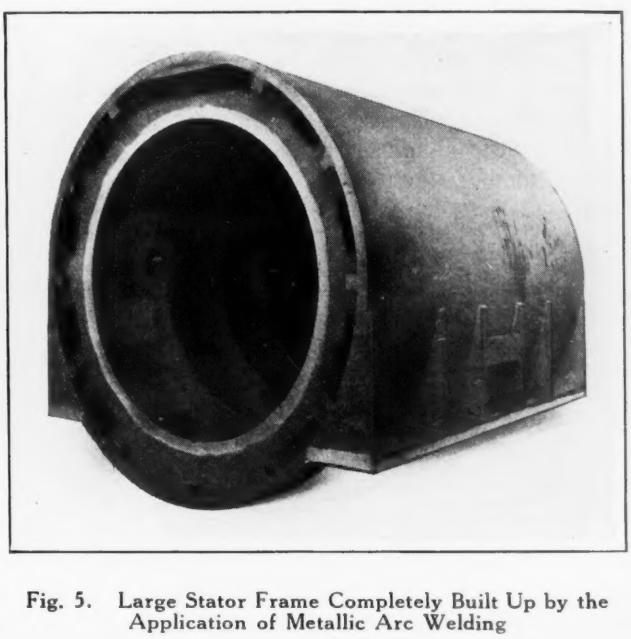


Fig. 5. Large Stator Frame Completely Built Up by the Application of Metallic Arc Welding

When the top and bottom rings have been completely welded to the wrapper plate, the angle-iron spacers are knocked out, after which the intermediate rings are "tack welded" to the wrapper plate and then completely welded in the same manner as the top and bottom rings. In the heading illustration, the operator is shown "tack welding" a ring to the wrapper plate before the application of the machine for automatically welding the ring in place. Machined bars are finally welded vertically along the inner edges of the rings for holding the stator laminations which are later assembled. Feet, lifting pieces, etc., are welded on the wrapper plate.

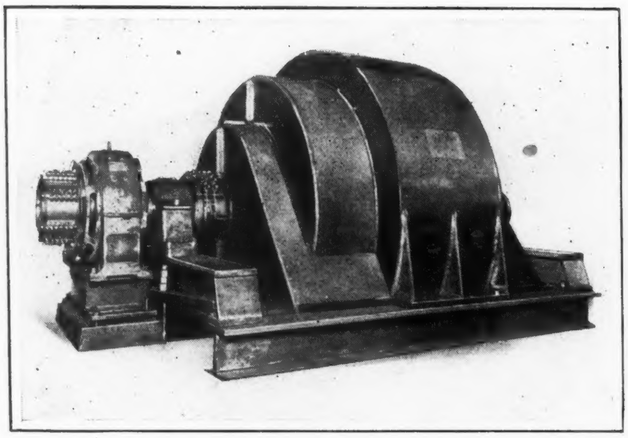


Fig. 6. Large Condenser which Has an All-steel Welded Housing, Base, and Bearing Pedestal

rings that on many frames no machine work is necessary, except drilling and tapping holes. The lamination supports are bored closely to diameter on a boring mill.

More Examples of Welded Parts

Fig. 5 shows a large stator frame completely built up by welding steel pieces together. The outside supporting plates and their ribs are clearly visible. In Fig. 6 is shown a 10,000-kilovolt-ampere synchronous condenser equipped with a direct-connected exciter. The housing of this apparatus is of all-welded construction, and the machine rests on a welded base.

Fig. 9 illustrates an all-welded top frame for a circuit breaker. It was first thought that this part could not be fabricated economically because of its complicated design, but by the use of four pieces of standard pipe, the job is performed profitably.

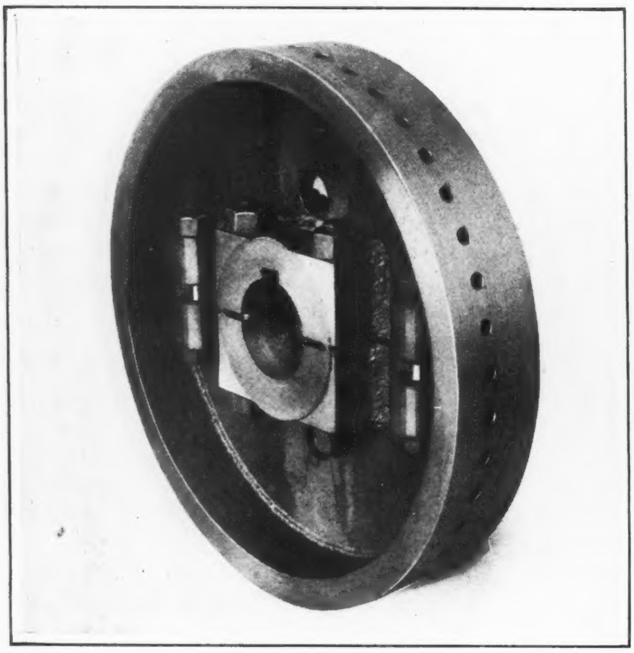


Fig. 7. Example Illustrating How Flywheels and Similar Parts Could be Fabricated

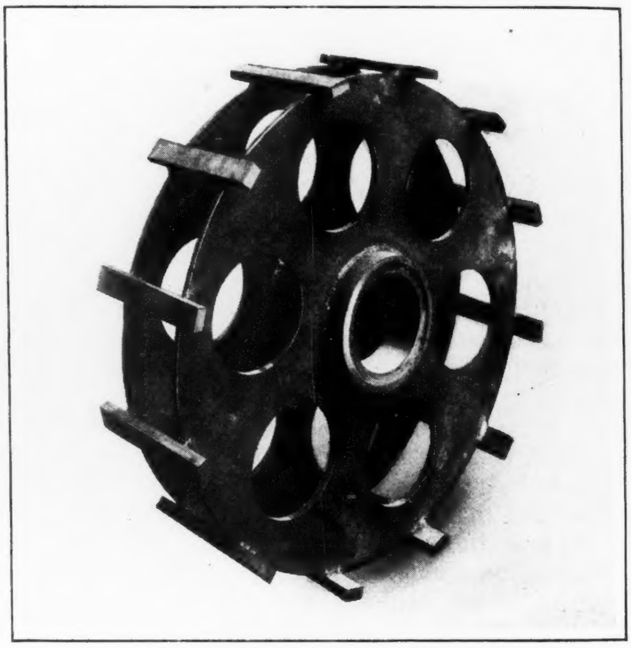


Fig. 8. Armature Spider Constructed of Disks, Plates, and Bars Welded Together

Stator frames from 10 to 40 feet in diameter are automatically welded by means of the machine illustrated in Fig. 4. Here the work rests stationary on cast-iron floor-plates, and the welding heads are carried around it. Each welding head is mounted on an upright which is provided with wheels that run on a circular track. The top end of the upright is joined to a pivot post in the center of the machine. A motor on each upright is geared to the corresponding wheels to drive the upright and welding head around the track. Stator frames up to the largest size are constructed in this manner with so little error in the diameter of the

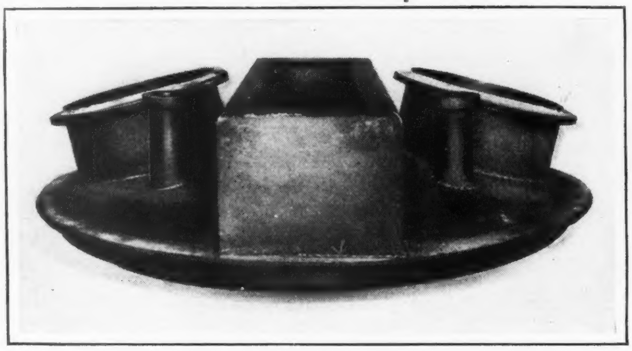


Fig. 9. Complicated Part Welded by Use of Standard Pipe

The split rotor spider shown in Fig. 7 has a heavy rim which was rolled into shape and the ends welded together. The web is made of two plates with a slight space between their adjoining edges at the middle. Welded to each half of the web are two bolt bosses and a half bearing. The bolt bosses are simple drilled round bars, and are fastened to the web pieces with a generous fillet of welding metal. When completed

as shown, slight adjustments of the bearing can be accomplished by tightening or loosening the nuts of the four bolts on each side of the web.

The armature spider shown in Fig. 8 has two large disks which have been cut out entirely in the machine illustrated in Fig. 1. These disks are mounted on a hub that was rolled from steel plate. In each end of this hub there is a ring, which was rolled from a comparatively narrow steel slab. After these parts were welded together, the bars were welded to the outside edges of the disks.

Standard pipe and structural shapes, such as angle-irons, I-beams, and H-sections, are used wherever possible in the fabrication of parts of various designs.

* * *

NEW HAVEN MACHINE TOOL EXHIBITION

The following list of exhibitors at the New Haven Machine Tool Exhibition to be held at New Haven, Conn., September 6 to 9, has been announced. This exhibition is held under the sponsorship of the New Haven Local Section of the American Society of Mechanical Engineers, the New Haven Chamber of Commerce, and the Department of Mechanical Engineering of Yale University. It is operated on a non-profit making basis by a committee of representatives of the organizations mentioned.

Air Reduction Sales Co.
Bausch & Lomb Optical Co.
E. W. Bliss Co.
Botwinik Bros., Inc.
Bristol Co.
Buffalo Forge Co.
Bullard Machine Tool Co.
Clipper Belt Lacer Co.
C. J. Dickgiesser
Divine Bros. Co.
Eastern Machine Screw Corporation
Fafnir Bearing Co.
General Electric Co.
Geometric Tool Co.
Goss & DeLeeuw Machine Co.
Keller Mechanical Engineering Corporation
Machinery Dealers' Corporation
Manning, Maxwell & Moore
National Acme Co.
New Britain Machine Co.
New Departure Mfg. Co.
New Haven Gas Light Co.
Noble & Westbrook Mfg. Co.
O. K. Tool Co., Inc.
N. W. Ordway & Son
Oxweld Acetylene Co.
Pneumatic Drop Hammer Co.
Potter & Johnston Machine Co.
Pratt & Whitney Co.
Purinton & Smith
Racine Tool & Machine Co.
S K F Industries, Inc.
Standard Machinery Co.
Timken Roller Bearing Co.
Torrington Co.
Triplex Machine Tool Co.

* * *

TRAINING AND DEVELOPING FOREMEN

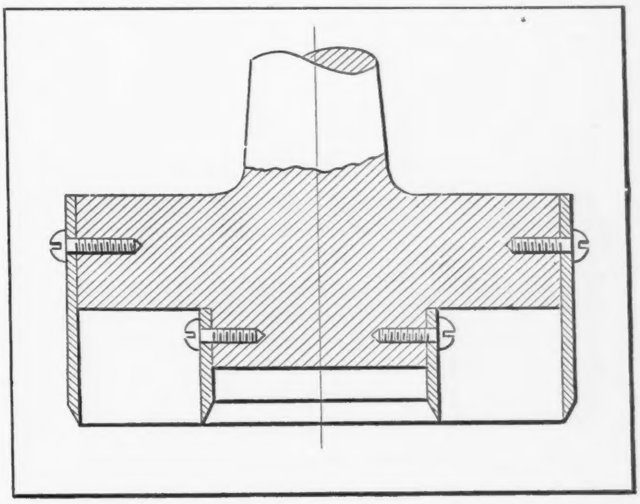
The importance of the foreman in modern manufacturing organizations is becoming more and more recognized. The foreman represents the firm to the men in his department. As far as the shop men are concerned, his policies, conduct, and methods are those of the firm. The firm is judged by its foremen. It is, therefore, of great importance that the foremen be able to interpret the firm thoroughly to the men, and in large industrial undertakings, the work of developing foremen and of keeping them in touch with the policies, aims, and purposes of the firm has been given very thorough consideration. The article "Training and Developing Foremen," which will appear in the August number of MACHINERY, records in detail what has been done by the Westinghouse Electric & Mfg. Co. in this direction. It will prove of great value to other concerns who recognize that their foremen are vital links in the industrial organization.

CUTTING FELT WASHERS ON A DRILL PRESS

By ARTHUR A. MERRY

The methods of cutting felt washers described in November MACHINERY, page 210, and in March MACHINERY, page 531, can be used to advantage in shops equipped with a punch press, but these methods cannot be used, of course, in a shop where a punch press is not available. The tool shown in the accompanying illustration should, therefore, prove of interest to many readers, as it is designed for use on a drill press.

The writer has used both the punch press and the drill press for this work, but prefers the latter method. The tool shown in the accompanying illustration, which is used on a drill press, need not be as rugged as the type used on a punch press, and it is less expensive to make. The washer cutter shown in the illustration is of the simpler type; a more elaborate design can be made in which a knock-out for the washer is provided. The knock-



Drill Press Tool for Cutting Felt Washers

out, however, is not really necessary, as the washers can be readily removed while the machine is running by picking them out with a sharp pointed instrument. As shown in the illustration, the cutter is nothing more nor less than a rotary knife. This cutter can be left harder than the cutters used in the punch press, and for this reason it will stand up much longer.

The type of cutter shown works equally well on paper, leather, and thin fiber. Another advantage of the drill press method is that the table of a drill press is larger than the table of a punch press, and therefore permits larger sheets of work to be cut with less risk of injury to the operator.

* * *

TRAVEL SCHOLARSHIP IN HYDRAULIC ENGINEERING

Through the fund established by John R. Freeman, past president of the American Society of Mechanical Engineers, a travel scholarship in hydraulic engineering amounting to $1800 is available to qualified engineers or teachers of hydraulic engineering who wish to pursue such studies in Europe. More complete information may be obtained by addressing Calvin W. Rice, secretary of the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

The Machine-building Industries

THERE has not been a great deal of change in the general business outlook during the past month. The iron and steel industry and engineering and building construction are continuing at about the same rate of activity. In the automotive industry, there was a slight seasonal decline during June as compared with the very satisfactory production in May. Car loadings continue at a high average, exceeding a million cars per week; the total car loadings since the beginning of the year exceed those for the same period of 1926.

Business opinion generally is optimistic. Francis H. Sisson, vice-president of the Guarantee Trust Co., New York, believes that there will be continued high industrial activity, with reasonable profits. J. H. Tregoe, executive manager of the National Association of Credit Men, states that the various adverse factors in business—the Mississippi Flood, the coal strike, and the over-production of petroleum—have not had any essential effect on the business situation. The credit situation is good and the deflation of commodity prices has prevented speculation. E. E. Loomis, president of the Lehigh Valley Railroad, sees a healthy outlook for business generally. The Federal Reserve Bank of Cleveland states that the general business situation is satisfactory, with prosperous conditions in many lines. There are, however, some adverse factors at the present time, chief of which is the destruction resulting from the Mississippi Valley Floods.

Engineering construction continues at record volume, the *Engineering News Record* placing the May figures in this field at $285,280,000 as against $241,337,000 a year ago, and $246,800,000 in April. Since the beginning of the year construction work in the engineering field has exceeded that of last year. Building permits, however, have decreased about 8 per cent.

The Machine Tool Industry Reports No Important Change

In the machine tool industry, conditions have not been uniform. Some machine tool builders state that business in May was good, while others found that the May business was not equal to that of April. For the industry as a whole, the amount of orders placed was slightly greater than in April. Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, points out that corporation reports indicate very satisfactory earnings for many large companies, while small manufacturers complain that business produces no profits at present prices. "From this," says Mr. DuBrul, "we can conclude that the prosperity of the larger corporations has been largely due to their ability to spend money on new plant equipment with which they have been able to cut their production costs. Concerns that have been unable to modernize their shops cannot compete with these modernized plants."

With regard to the prospects for the immediate future, Mr. DuBrul states that with money as cheap as at present, and used as freely by those who can command credit for plant expansion, the machine tool industry may expect the present level of orders to remain unchanged for the summer.

Small Tools and Accessories—Bearing Metals

The "spotted" condition in the standard machine tool field is also found in tools and accessories generally. In the electrical tool field, some firms state that business this year has been ahead of last year, others have found it about equal, and still others have not had the same volume. The industrial gear business in some parts of the country has held its own, while in others it has fallen off.

The outlook for the rest of the year in the bronze bushing and bearing field is exceptionally bright, according to P. J. Flaherty, president of the Johnson Bronze Co., Newcastle, Pa., who states that the production of his company's plant is at the highest point in its history. "While the demand from the automotive field is unusually good," says Mr. Flaherty, "due to automobile and truck production and to increased attention to the replacement of worn bushings in the process of reconditioning these vehicles, the general industrial field is responsible for a good share of the growing demand for finished bronze bushings and bearings. Manufacturers of all types of machines and motors are finding it to their advantage to buy finished bushings from the specialized bushing maker."

Exports of Industrial Machinery Reach High Level

The exports of industrial machinery during April, the last month for which complete statistics are available, exceeded those for any month during the last five years. The principal activity is in oil-well and metal-working machinery. The total exports in the industrial machinery field amounted to $17,339,000, representing a gain of more than $1,460,000 over the shipments for April, 1926, the previous record month.

Of the exports in April, 1927, metal-working machinery represented $2,251,700, the total for the first four months of the year being $7,251,000. The types of metal-working machines that have gained most during the first four months of the year are cylindrical grinding machines, internal grinding machines, shapers, slotters, and engine lathes. During the first four months of the year, cylindrical grinding machines were exported to a value of nearly $550,000; internal grinding machines, $310,000; shapers and slotters, $207,000; and engine lathes, $370,000.

Five Months' Output of the Automobile Industry

The automobile plants that are members of the National Automobile Chamber of Commerce produced 1,454,700 cars and trucks during the first five months of this year, as compared with 1,296,000 cars in the same period last year. Practically all the leading automobile manufacturers are members of the chamber, with the exception of the Ford Motor Car Co.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

ROCKFORD COMBINATION HORIZONTAL AND VERTICAL BORING MACHINE

The latest development of the Rockford Drilling Machine Co., Rockford, Ill., is a combination horizontal and vertical three-way boring machine which has two opposed horizontal heads and one vertical head. Nine holes are bored simultaneously in heavy transmission cases with the particular machine illustrated. Each head of this machine contains three spindles. The driving arrangement of the heads is simple, and the claims made for it are greater driving power with less current consumption.

A motor is mounted directly in each head and drives through worms and worm-gears, which give speed reductions, and through spur pick-off gears, which give speed variations. The pick-off gears are conveniently changed from the sides of the head. In addition to the wide range of spindle speeds available through the pick-off gears, two separate speeds are obtainable by shifting a convenient lever which is also employed to start and stop the rotation of the spindles independently of the motor control. With this arrangement, there are but eight gears in the drive proper to each head. All rotating parts in the drive proper are mounted in Timken tapered roller bearings and run in a bath of oil.

The spindles, which are provided with ball thrust bearings, are incorporated into a complete unit which fits into the front of the head proper and becomes an integral part of it. The spindles run in double bearings, one on each side of the spindle drive gear or idler, as the case may be, to insure constant alignment and long life. This unit also runs in oil.

A feature that eliminates this type of machine from the single-purpose class is the fact that the spindle units are interchangeable in the head proper. Thus, it is possible to provide for operations on a variety of work by using auxiliary spindle units having a smaller or greater number of spindles, which are located to suit the requirements of the work.

Each head, with the motor, drive proper, and spindle unit, is traversed back and forth on scraped ways by means of Oilgear equipment. The class of work to be done determines whether each head is to be operated by an individual pump or whether two or more heads can be operated by one pump. The particular machine illustrated requires three individual pumps and controls, each pump being driven by a three-horsepower motor running at 900 revolutions per minute.

Either a hand or automatic control can be provided for the Oilgear equipment. With the hand controlled type of pump, the operator must engage each function desired, while with the automatically controlled pump, the operator engages the rapid approach only and the automatic feature engages all remaining functions through a complete cycle. Automatic stops are provided with either type for the forward and reverse traverse.

The fixture on the machine illustrated was also made by the Rockford Drilling Machine Co. To permit loading and clamping the work conveniently, arrangements are made for swinging the entire fixture forward on a pivot. Stationary, indexing, cross-sliding, or drum-type tables can be furnished to suit different classes of work.

Machines of this type can be built

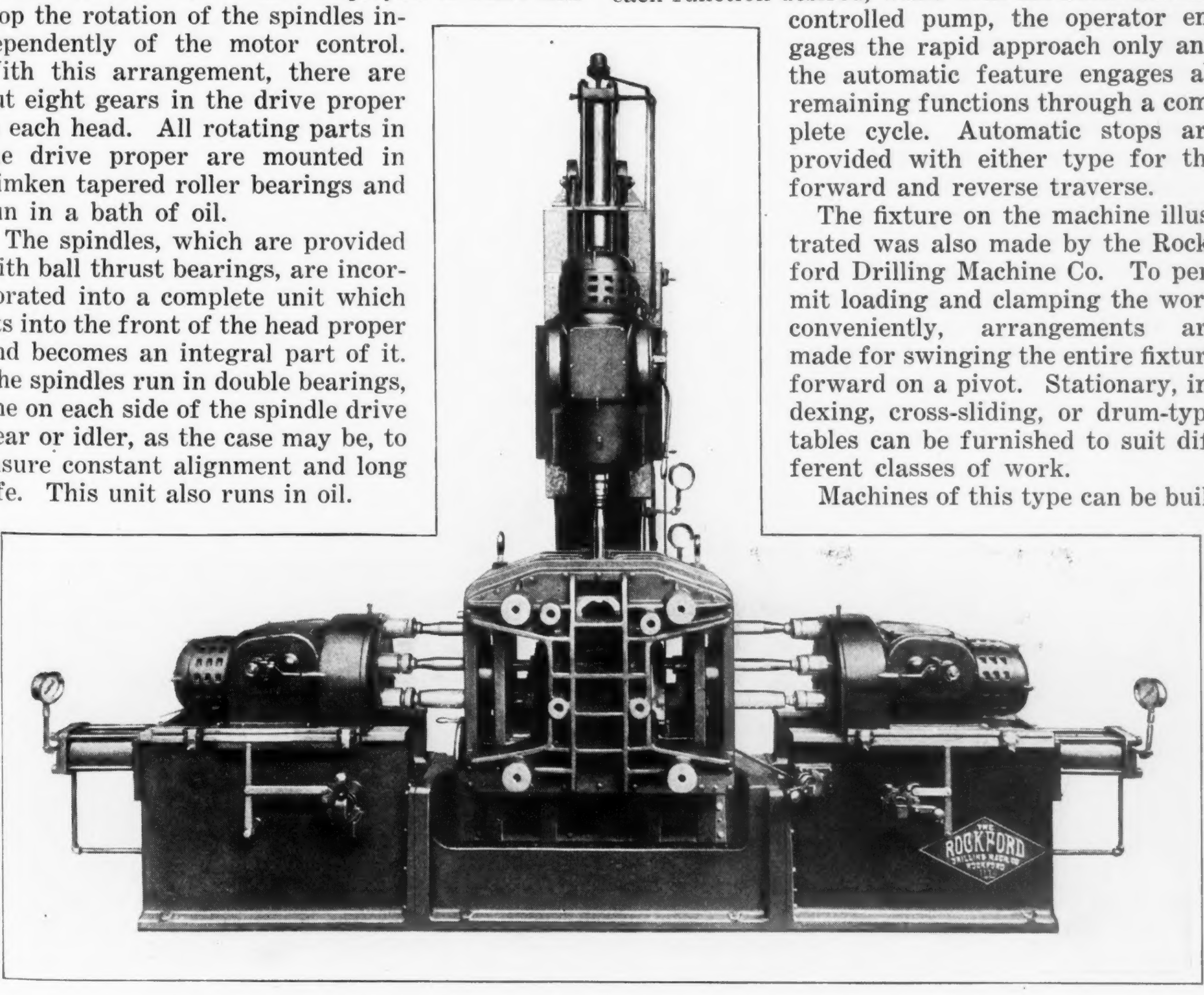


Fig. 1. Rockford Boring Machine with Two Horizontal Heads and One Vertical Head

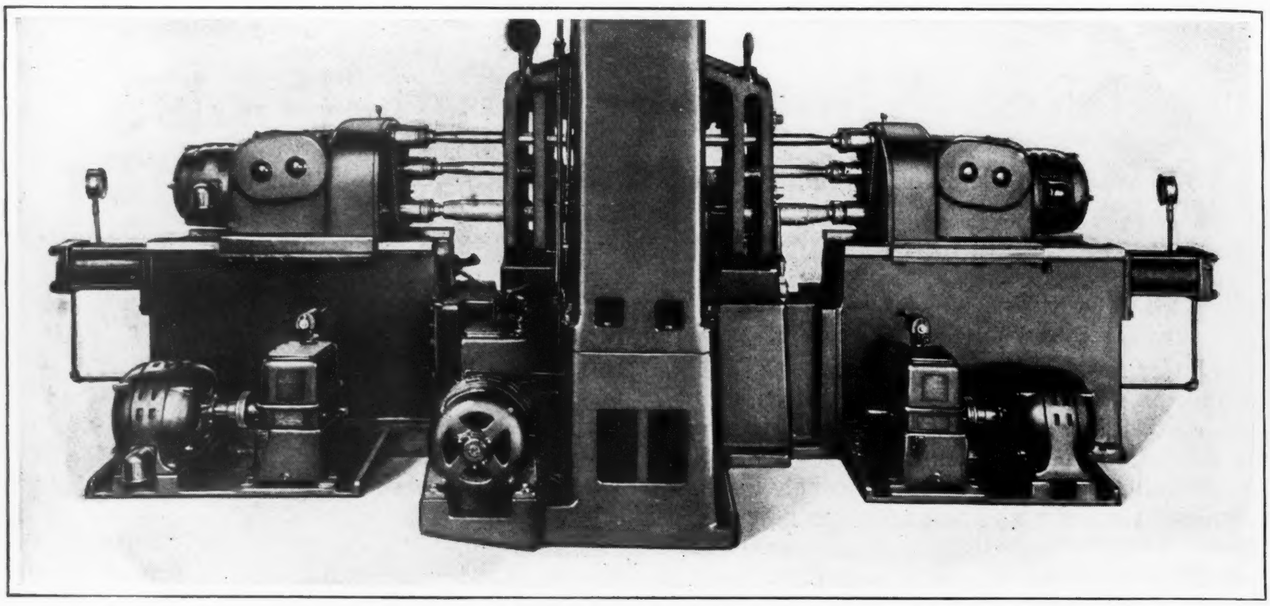


Fig. 2. View of Rockford Boring Machine, Showing the Three Oilgear Pumps and Their Driving Motors

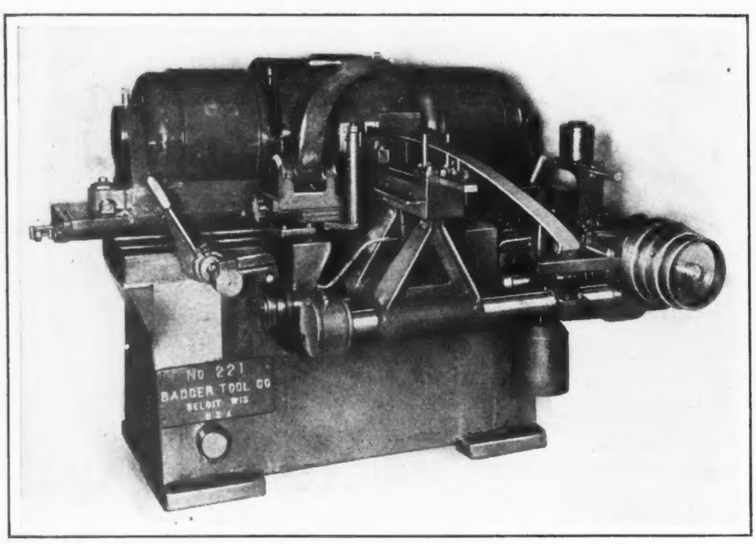
in a large variety of arrangements, such as single-end, double-end, three-way as shown, or three-way with all heads in a horizontal plane.

BADGER LEAF SPRING GRINDER

A machine for automatically grinding the sides of the eyes of leaf springs and bumpers, which has been developed by the Badger Tool Co., Beloit, Wis., is here illustrated. This machine, designated the No. 221, is of the double-spindle type, each wheel-spindle being driven by a 7 1/2-horsepower built-in motor and carrying a cylinder grinding wheel held in a chuck. The work-carrying member consists of a ram, adjustably mounted on two parallel arm castings. A camshaft acts as the support for the inner arm, whereas the outer arm is mounted on a parallel shaft which imparts the drive to the work-carrying ram. The camshaft is driven through worm-gearing enclosed in a housing located at the extreme right-hand end of the machine.

A large cam which controls the motion of the work-carrying ram is removably mounted on the outer end of the camshaft. A short distance from the same end of this shaft is fastened an arm and weight by means of which a roller is caused to follow the large cam, thereby producing the predetermined motion of the ram which carries the spring eye in and out between the two grinding wheels. The cam is not only away from the grinding path, but is in a location where it can be easily removed for substituting cams of different shapes. Cams are formed to give the proper relation between the actual grinding time and the idle time, the idle portion of the cam being used when the work fixture is out from between the grinding wheels.

In conjunction with the forward and reverse motion of the ram, the grinding wheel heads open and close automatically, thereby leaving both hands of the operator free to handle springs. Two cams attached to the camshaft open the heads, while two levers and weights at the rear of the machine close the heads up to independent micrometer stop-screws. Feeds can be increased or decreased by merely varying the amount of weights used. Four speeds can be secured through a cone pulley driven by a separate one-horsepower motor. The wheel dresser is conveniently mounted at the front of the machine. It has a lateral adjustment so that the wheels can be quickly reached and dressed in parallel planes.

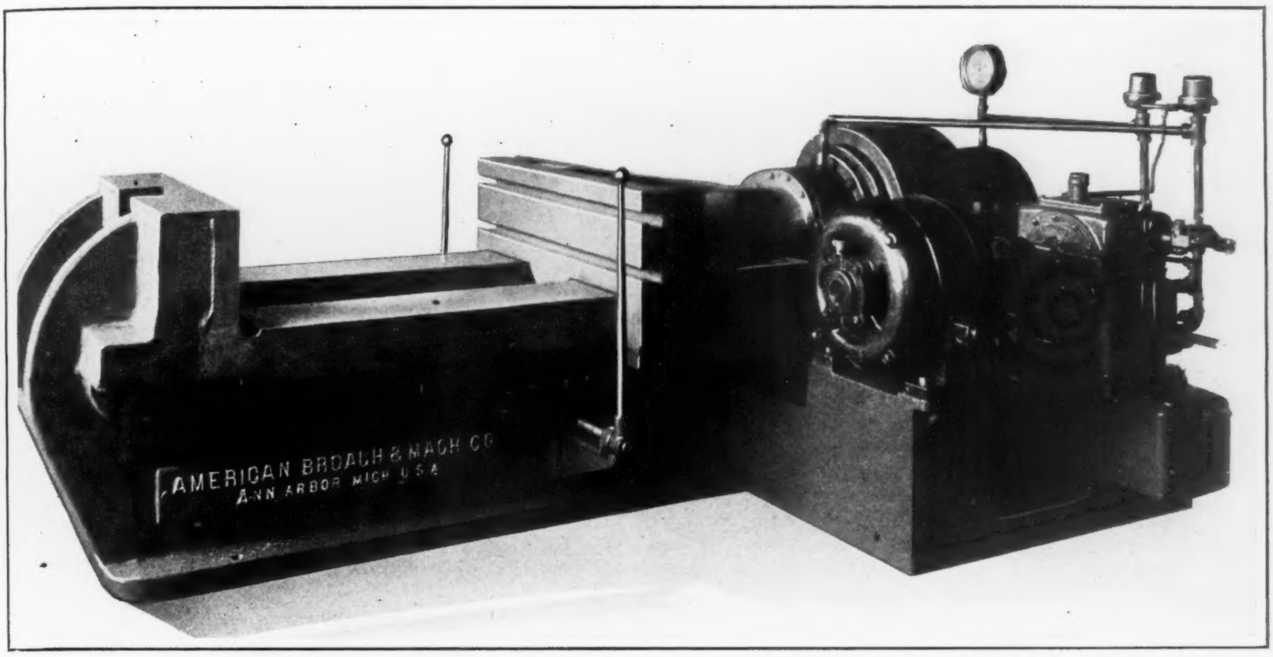


Badger Grinder Built for Finishing the Eyes of Leaf Springs

The machine can be furnished with a belt drive as well as a motor drive, and can be equipped for wet or dry grinding. Cylinder wheels up to 20 inches in diameter and disk wheels up to 24 inches in diameter can be used. With the built-in motor drive illustrated and with the machine arranged for dry grinding, the entire equipment weighs about 6000 pounds.

AMERICAN HYDRAULIC HORIZONTAL PRESS

A 100-ton hydraulic horizontal press or bulldozer of the construction here illustrated has recently been brought out by the American Broach & Machine Co., Ann Arbor, Mich. This machine is equipped with an oil-pump which gives a maximum



American 100-ton Hydraulic Press of Horizontal Construction

pressure of 1000 pounds per square inch. The operating speed of the press on the pressure stroke is 18 inches per minute, and on the return stroke, 36 inches per minute. The pump is driven by a 7 1/2-horsepower motor. A gage graduated to read to 125 tons is furnished, and the machine is fitted with stops which provide for predetermined lengths of stroke and which also prevent over-running of the ram.

Some of the principal specifications of the press are as follows: Width of stationary jaw, 36 inches; height of stationary jaw, 11 1/2 inches; width of sliding jaw, 44 inches; height of sliding jaw, 11 3/4 inches; stroke of sliding jaw, 18 inches; minimum and maximum distance between jaws, 32 and 50 inches, respectively; height from floor to top of ways, 25 inches; and approximate weight of machine complete with motor, 20,000 pounds.

LANDIS SELF-CONTAINED UNIVERSAL GRINDING MACHINES

A line of self-contained universal grinding machines ranging in size from 12 by 30 inches to 16 by 60 inches has recently been developed by the Landis Tool Co., Waynesboro, Pa. These machines have practically the same range as the overhead-driven universal machines built by this company, and all the other features are the same. Each machine is equipped with three motors, one of which drives the work-head, another the wheel-head, and the third, the carriage power-traverse and water pump.

The headstock is driven by a 1/2-horsepower direct-current adjustable-speed motor, equipped with a field rheostat control and running at from 500 to 2000 revolutions per minute. This motor may be furnished for either 115 or 230 volts, but it must be of the direct-current adjustable-speed type. It is mounted directly on the headstock, and drives through sprockets and a silent chain to a worm-shaft. Power is transmitted by this shaft to a worm-gear mounted on the spindle. The worm is hardened and ground, and the gear is made from a bronze alloy. The gear is partly submerged in oil.

Driving of the wheel-head is accomplished through a three-horsepower constant-speed motor, running at 1750 revolutions per minute. This motor is mounted directly on the wheel-head slide, as shown in Fig. 2, and transmits power to the spindle through a multiple V belt. A spring idler gives the necessary tension and compensates for stretch.

The drive to the carriage power-traverse and water pump is through a two-horsepower constant-speed motor, also running at 1750 revolutions per minute. This motor is mounted on the rear of the water tank, and power is transmitted through a chain and sprockets to a shaft, on one end of which the impeller of the water pump is mounted. From the other end of this shaft, power is transmitted to a two-speed gear-box which, in addition to the regular friction speed change, gives the traverse speed range. The power from the gear-box to the friction speed change is delivered through a belt furnished with a gravity idler.

Facilities are provided for mounting a direct-current generator on the rear of the machine when

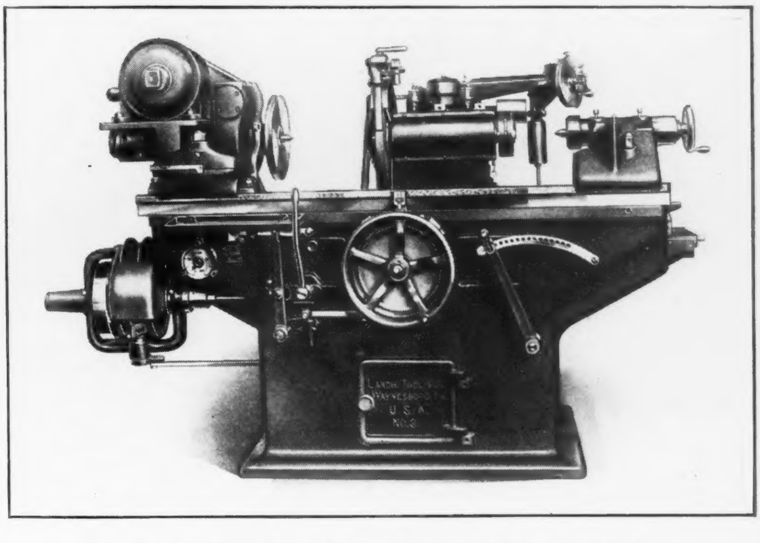


Fig. 1. Landis Motor-driven Universal Grinding Machine

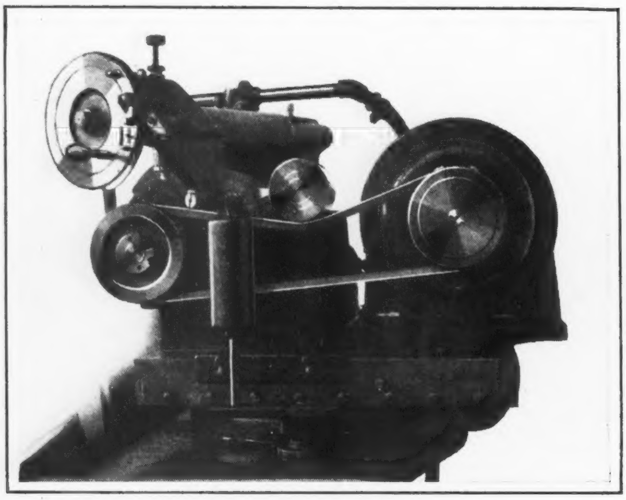


Fig. 2. Method of Driving the Grinding Wheel

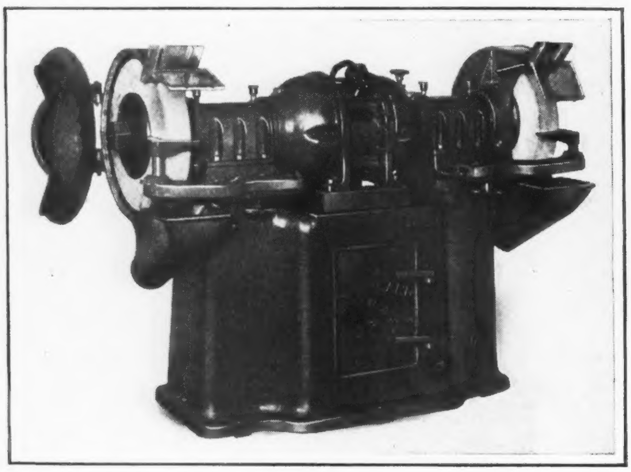
direct current is not available in the user's plant. This generator is driven from one end of the traverse drive motor through a flexible coupling. When this is done, a larger traverse drive motor is required than is regularly supplied.

The headstock, which is movable along the swivel table, is arranged for either live- or dead-spindle operation, and can be changed quickly from one to the other. It is of the universal type, and can be swiveled to grind short tapers from 0 to 90 degrees. It can also be swiveled for face-grinding.

A single lever controls the starting and stopping of both the work and the power traverse, but it is possible to use the power traverse without rotating the work. The regular reversing mechanism used on the previous overhead-driven machines is employed on the new self-contained types. The regular standard equipment for complete universal grinding work is also furnished. These machines range in weight from 5600 to 7500 pounds net.

HEAVY-DUTY MOTOR-DRIVEN GRINDER

A heavy-duty motor-driven grinder, recently added to the line manufactured by the Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio, is shown in the accompanying illustration. This machine is made in three sizes of 5, 7 1/2, and 10 horsepower capacity, respectively. The wheels of the 5-horsepower grinder are 18 inches in diameter by 3 inches face width and have a 2-inch bore; those of the 7 1/2-horsepower machine are 24 inches in diameter by 4 inches face width and have a 2 1/4-inch bore; and those of the 10-horsepower grinder are 24 inches in diameter by 2 3/4 inches face width and have a 2 1/4-inch bore. The machines weigh 1920, 2020, and 2375 pounds.

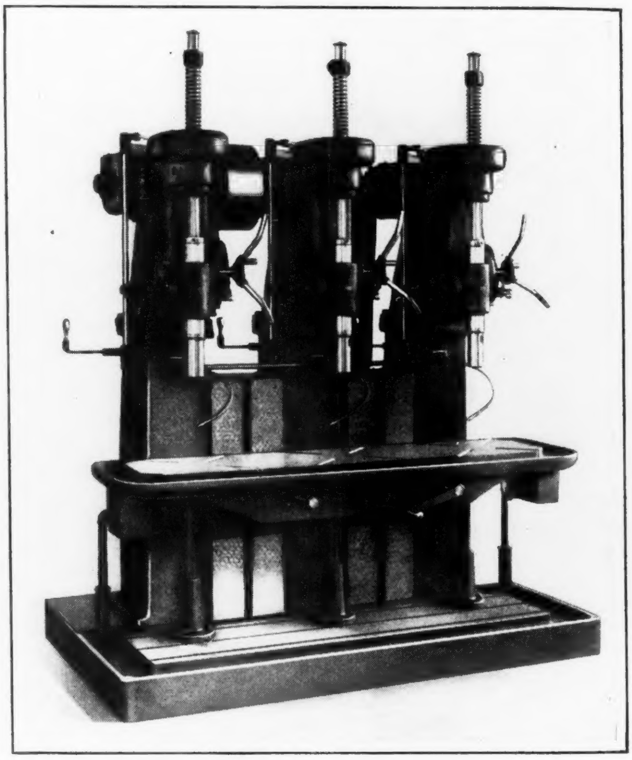


Standard Electrical Tool Co.'s Motor-driven Grinder

Each grinder is equipped with a General Electric motor and push-button control. There are four S K F ball bearings, and these are enclosed in dust-proof chambers. The armature shaft is made of nickel steel, and is fitted with a shaft-locking device for use in changing wheels. The wheel guards are provided with exhaust connections, spark breakers, and wired-glass eye shields.

BARNES DRILL CO.'S GANG DRILL

A three-spindle No. 210 self-oiling, all-geared gang drilling machine has recently been built by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. This machine is designed primarily for single-purpose work, that is, for use in large production operations where frequent changes of speeds and feeds are not necessary. It can be arranged for any one predetermined speed and either one or two quick changes of feed. When it is necessary to change speeds, this can be readily accomplished by exchanging the crown gears.



Three-spindle Single-purpose Machine Built by the Barnes Drill Co.

This three-spindle machine embodies the various features of the No. 210 single-spindle machine described in April, 1925, and November, 1924, MACHINERY, such as the six-spline spindle construction, ball bearings throughout, self-oiling system, all-steel gears, and star-wheel handle. This handle is located low down on the right-hand side of the machine and operates through an internal gear mechanism, which gives a leverage of 35 to 1. Each spindle has an automatic clutch control. An automatic reverse can be provided for tapping.

Instead of a single long drive shaft for all three spindles, couplings are used between the spindle

heads, so as to permit the radial ball bearings to be easily lined up on the drive shafts. The column has double ways on which the table is secured and gibbed. It is supported by means of three raising screws. The spindle sleeves and racks are of a patented dovetail construction in which screws are eliminated, and the thrust is taken by a key.

BLANCHARD SURFACE GRINDER FOR ASBESTOS CLUTCH FACINGS

Asbestos clutch facings of either the molded or woven type are automatically ground in a special surface grinder built by the Blanchard Machine Co., 64 State St., Cambridge, Mass. This special machine is a modification of the No. 16 high-power surface grinder built by the same company. The work-table is made of cast iron, and is fitted with steel cleats, so arranged as to provide pockets to

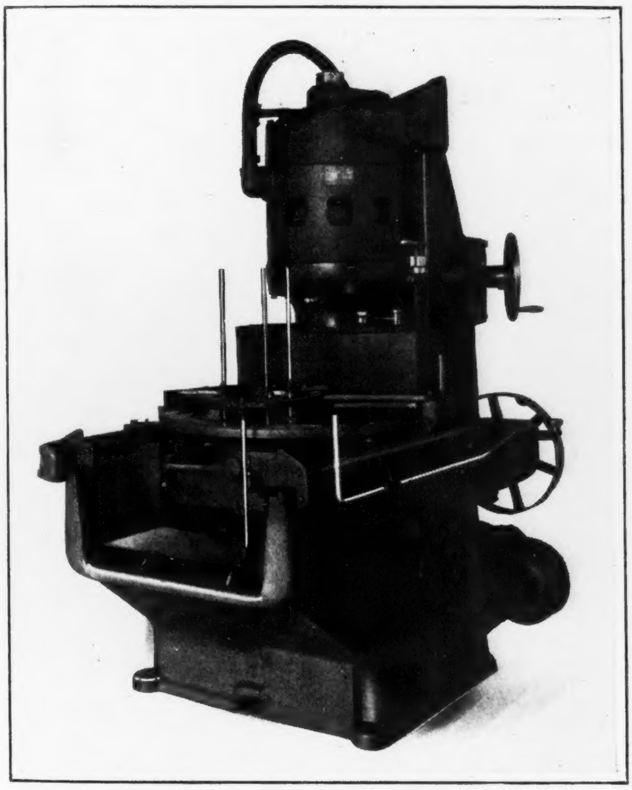


Fig. 1. Blanchard Grinder for Asbestos Clutch Facings

receive the work. The clutch facings are stacked in the vertical magazine, and as the table with its cleats passes under the pile, each set of cleats receives one clutch facing from the bottom of the pile.

As a clutch facing is taken from the pile, it is held down in contact with the table by presser feet, which are stationary, but are adjustable for different thicknesses of work. These feet are the curved bars seen at *A* and *B*, Fig. 2. They extend from the magazine around to the grinding wheel, and also cover the space that is inside the grinding wheel when the wheel is lowered, so that the work is held down against the table either by the presser feet or the grinding wheel until the operation is completed. After coming from under the wheel, each clutch facing is lifted and discharged from the table by the inclined shoe and guide at *C*.

The grinding is thus done in one pass under the wheel, during which about 1/64 inch of material

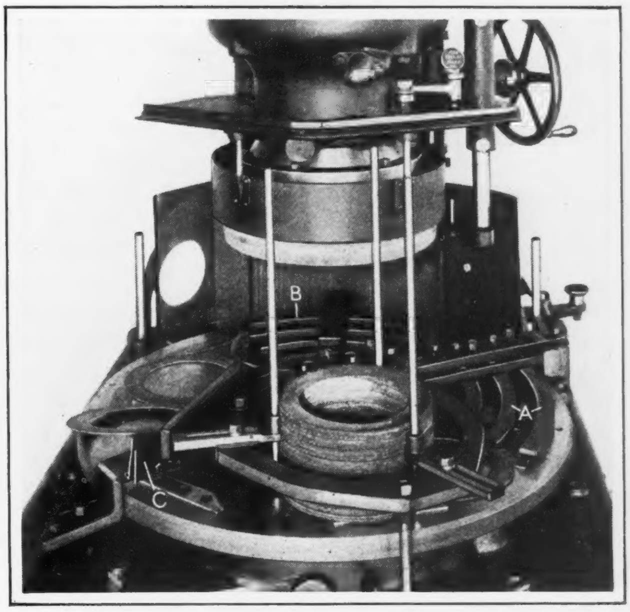


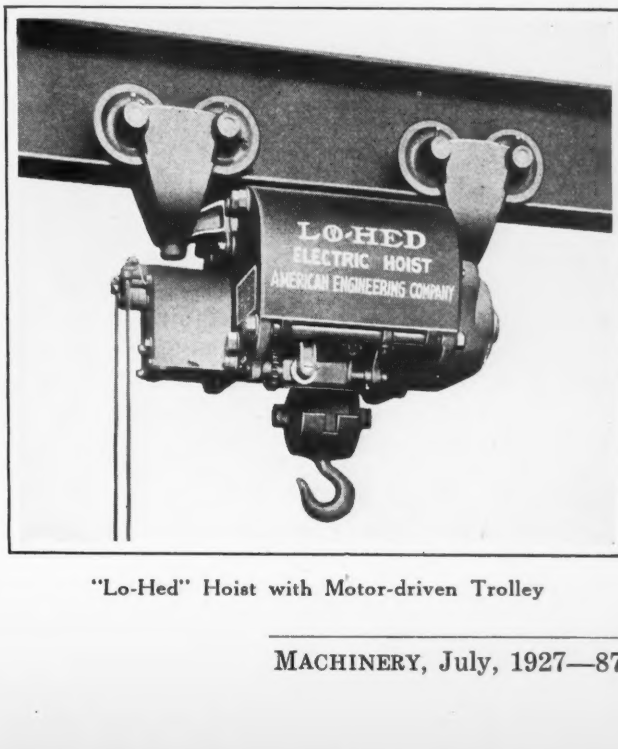
Fig. 2. Arrangement of the Table Equipment

is removed. An exhaust system removes the waste material, the grinding being done dry. The wheel and the portion of the table where the grinding is done are so completely enclosed by guards that no dust can escape into the room. Wheel wear is slight, and is compensated for by a simple hand feed.

The magazine is adjustable to receive facings from 6 to 12 inches in diameter, and a second magazine can be furnished to accommodate facings from 3 to 6 inches in diameter. The presser feet handle all sizes of facings up to 12 inches in diameter and 5/16 inch in thickness. The cleats on the table must be changed for any considerable difference in the work diameter. Production varies according to the size of the facings, but on facings 10 inches in diameter from which 0.015 inch of stock is removed from each side, the production is over 1200 facings (2400 surfaces) per hour. The surfaces are parallel within 0.002 inch, and are held to size within plus or minus 0.002 inch.

"LO-HED" MOTOR-TROLLEY HOIST

A motor-trolley electric hoist that operates on one rail in 15 1/2 inches of head-room, has been



"Lo-Hed" Hoist with Motor-driven Trolley

added to the line of "Lo-Hed" hoists manufactured by the American Engineering Co., Philadelphia, Pa. The new hoist is built in 1/2- and 1-ton sizes, and is similar in construction to the standard class A "Lo-Hed" hoist, with the exception that it is mounted on an eight-wheel motor-driven trolley that reduces the head-room requirement more than 5 inches.

The hoist is made for operation at 20 feet per minute with alternating current, or from 20 to 40 feet per minute with direct current. A special high-speed hoist operates at 40 feet per minute with alternating current, and from 40 to 80 feet per minute with direct current. The standard lift is 20 feet, but a lift of 25 feet can be provided. Four ropes are used. A remote control of both the hoist and trolley motors can be furnished.

Hyatt bearings are used on the gear shafts and in the trolley wheels. The ball-bearing hoist motor is designed especially for hoist service. A spur gear drive is used between this motor and the drum, the gears running in oil. "Alemite" lubrication is provided for all bearings not automatically lubricated by the oil bath. Holding and lowering brakes give full control of the hoist at all times, and there is a positive-acting upper limit device.

ROTOR AIR SANDER

Two new models of a pneumatically operated sander have been placed on the market by the Rotor Air Tool Co., 5905 Carnegie Ave., Cleveland, Ohio, which concern has recently purchased the pneumatic tool division of the Warner & Swasey Co. The new sander is based on the principle described in February, 1925, MACHINERY. It is designed for the performance of such metal finishing operations as grinding, sanding, and wire-brushing.

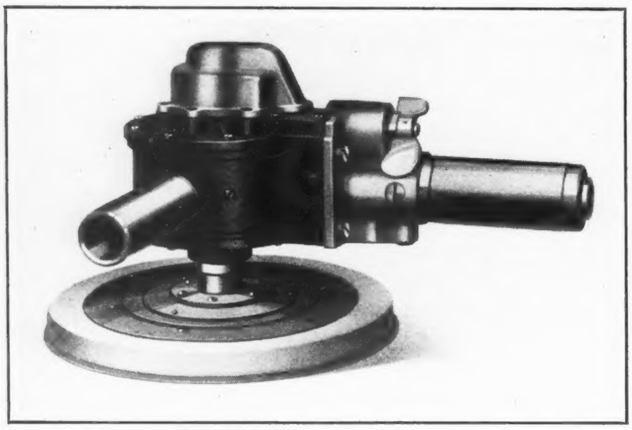


Fig. 1. Rotor Air Sander Equipped with Sanding Disk

The motor is mounted directly over the pad or wheel, so that the latter is driven direct without gears. An adjustable governor permits of easily changing the speed from 4500 to 6500 revolutions per minute, so as to make the machine suitable for use with either 9- or 7-inch pads. The speed is automatically reduced when the pad or cup-wheel is removed from the work. Oil is supplied through a reservoir in the handle, and it can be regulated by means of an adjustable needle valve. Features pointed out for the sander are light weight, good balance, and freedom from vibration. Maintenance costs are said to be low, as there are only three moving parts and the rotor shaft runs in ball bearings.

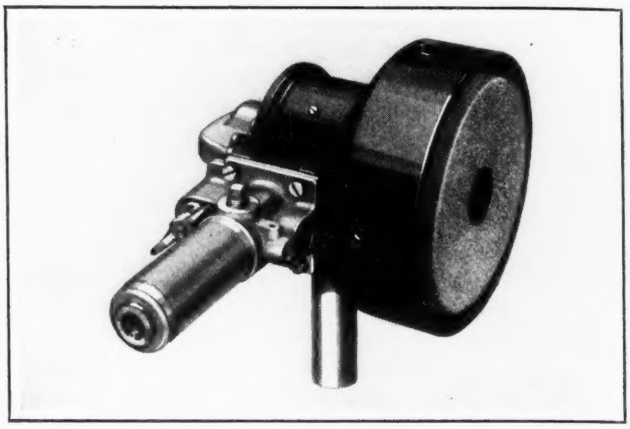
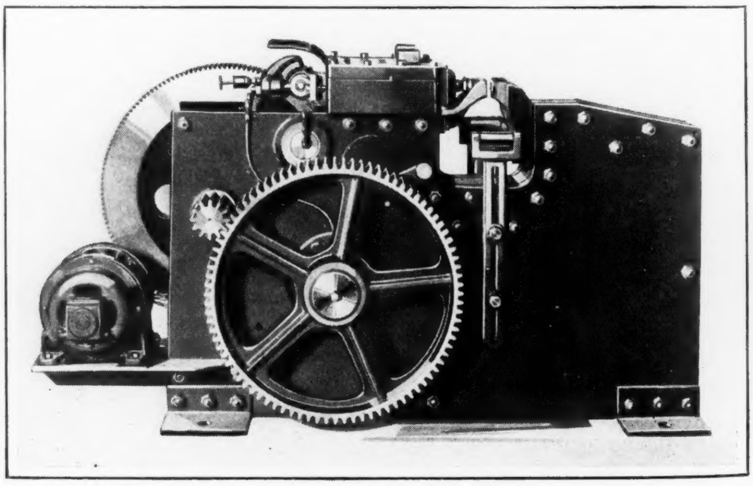


Fig. 2. Sander with Cup-wheel and Adjustable Wheel Guard

When equipped with a sanding disk, the device is suitable for finishing automobile bodies, metal furniture, metal refrigerator cabinets, etc., and for finish-grinding semi-steel die-blocks and machine castings. When equipped with a cup-wheel, it is adapted for rough-grinding electrical welds on automobile bodies, metal furniture, refrigerator cabinets, and steel fabricated units. The device is also suitable for cleaning rust from metal surfaces, or for cleaning scale and rust from tank cars and structural steel work, when provided with a wire cup brush. The weight of the sander without the disk pad is 11 pounds.

BUFFALO "ARMOR-PLATE" HORIZONTAL PUNCH

A horizontal punch of the construction here illustrated has recently been added to the line of "Armor-Plate" punches, shears, and bar cutters built by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. This new punch is designed to conveniently punch flanged pieces, boiler heads, curved angle-irons, beams, channel-irons, and other shapes that cannot be handled to advantage by a vertical machine. All gears, flywheels, etc., are located below the top of the machine, where they do not interfere with handling any shape of bent section.



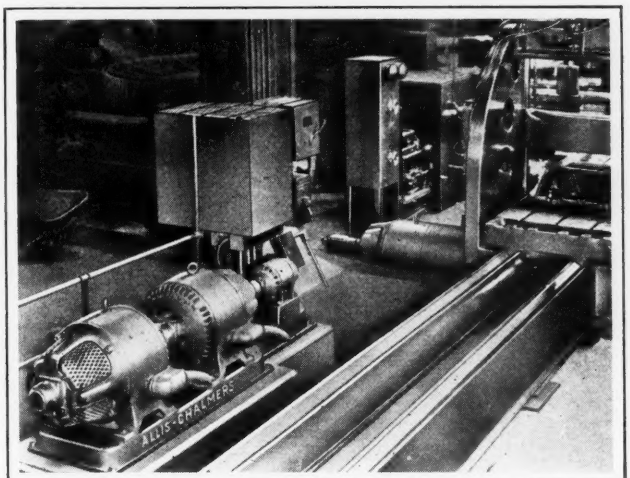
Buffalo Horizontal Punch of "Armor-Plate" Construction

The jaws are of a design that permits punching close to corners of angle-irons, I-beams, and channel-irons through the webs or flanges, and punching H-sections through the flanges.

A semi-floating punch-head enables the punch to be lowered for accurately locating centers. The punch is engaged by a foot-trip. Operation is accomplished through a cast-steel rocker arm mounted on a bronze-bushed king pin which is stationary in the frame. Wear of the ram is taken up by means of bronze-bushed eyebolts, which constitutes a new feature on all Buffalo machines. The frame of the machine is made up of two heavy "Armor-Plate" steel plates. Standard machines have a short throat, but larger throats can easily be provided. This machine is built in four sizes, ranging in weight from 3650 to 14,000 pounds.

ALLIS-CHALMERS PLANER DRIVE

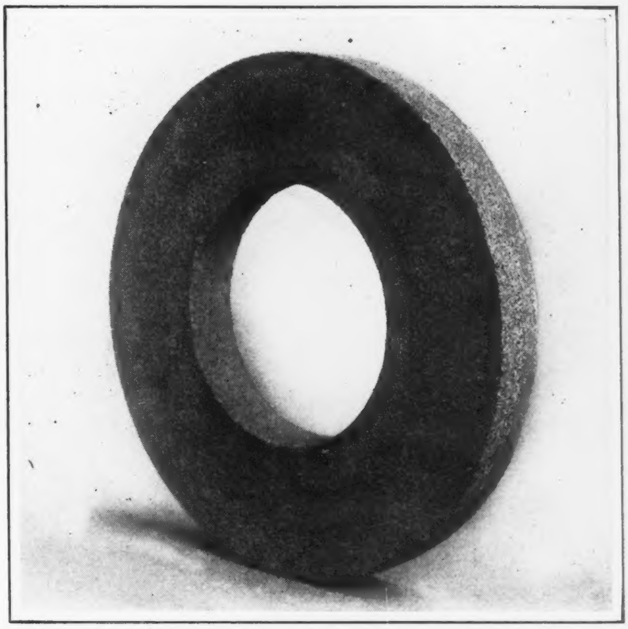
A new planer drive has been developed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., the object of which is to make possible greater production on planers. The outstanding features of this drive are greater range of speeds than heretofore available—10 to 85 feet per minute cutting speed with full torque; 180 feet per minute return speed;



Planer Drive Developed by the Allis-Chalmers Mfg. Co.

fifty or more different cutting speeds; new type pendent automatic control; safety to operator, planer, and work; great overload capacity; and ability to operate on direct or alternating current.

The planer operator's limited knowledge of electrical apparatus has been borne in mind in working out the details of the control, so that he can operate and adjust it with ease and with a minimum number of movements. An important safety feature prevents injury to any part of the equipment or the planer in case the power supply is cut off. The planer motor is specially designed to withstand the severe strains of reversing planer service. The rotating parts have a large factor of safety, are dynamically balanced, and have low inertia.



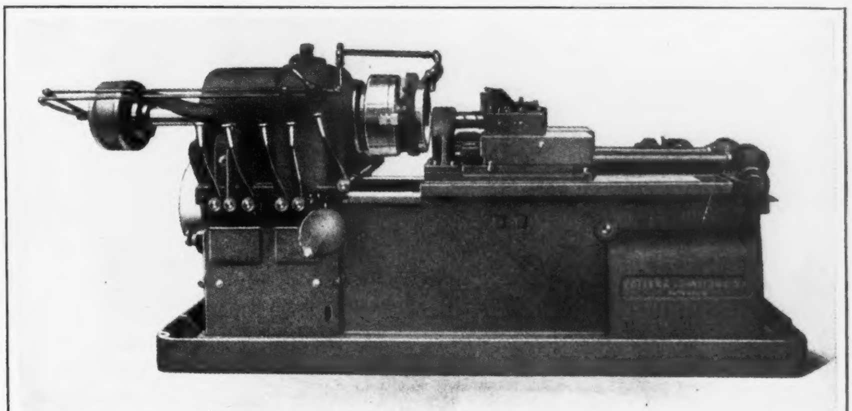
Norton Grinding Wheel for Snagging Operations

NORTON SNAGGING WHEEL

After long and thorough experimentation and trials, the Norton Co., Worcester, Mass., has brought out a new grinding wheel for snagging operations. This wheel employs bakelite as the bonding material, and is designed for high-speed operation—9000 surface feet per minute. The use of bakelite produces a wheel which has the open structure of a vitrified wheel, but which can be operated with safety at the high speed mentioned. Another advantage of the bakelite bond is that it is not affected by heat. A considerable increase in production, both per unit of time and per unit of abrasive, results from the high speed at which this wheel can be operated.

POTTER & JOHNSTON PLATEN-TYPE AUTOMATIC

Chucking and between-centers work of a wide range can be handled by the No. 6-DP automatic platen-type chucking and turning machine manufactured by the Potter & Johnston Machine Co., Pawtucket, R. I., which is now being introduced on the market with many improved features incorporated in its design. A number of cuts can be taken simultaneously, the machine being particularly



Potter & Johnston Automatic Platen-type Chucking and Turning Machine

adapted to work requiring heat-treatment or cooling between roughing and finishing operations. One man can operate several machines.

The machine is of unit construction, the headstock, feed-box, and platen being built in units. The base is of heavy box design and is provided with extra wide flat ways at the front and rear. It is constructed to give plenty of chip clearance. The pan serves as a reservoir when cutting lubricant is used, a metal grating preventing chips, etc., from getting into the cutting compound.

The spindle is a high-carbon steel forging, mounted on Timken tapered roller bearings. The spindle gears have spiral teeth, and are made of chrome-nickel steel. They run in a bath of oil and the bearings are flood lubricated. Four automatic changes of speed and three automatic changes of feed are furnished when required. These changes are entirely independent of the variations possible in the individual slide cams.

The drive is through a constant-speed pulley equipped with a multiple disk clutch and a brake. Multiple disk clutches are also employed within the headstock to provide for the automatic speed changes. An automatic spindle stop allows the cutting tools to return to their neutral position without unnecessarily scoring the work, after the operation has been completed. When advantageous, the machine may be provided with a standard feed-box unit which gives three selective automatic feed changes.

The platen or table is mounted on the wide ways of the bed. It is moved to and fro by means of a cam-drum, provided with hardened cams that are ground on the dwell portion. On the platen there is a removable plate on which a number of tool-slides may be fastened to accommodate the particular work to be handled. Movement of the platen, therefore, may be utilized for cutting, as well as for bringing the tool-slides into the operative positions. Standard tool-slides measure approximately 10 by 18 inches. The entire feed mechanism for these slides runs in oil.

For work that is to be held between centers, the machine is provided with a live center unit which is bolted to the platen. When work of this class is being handled, the longitudinal travel of the platen is eliminated, the platen being clamped to the bed. The live center is mounted on Timken tapered roller bearings.

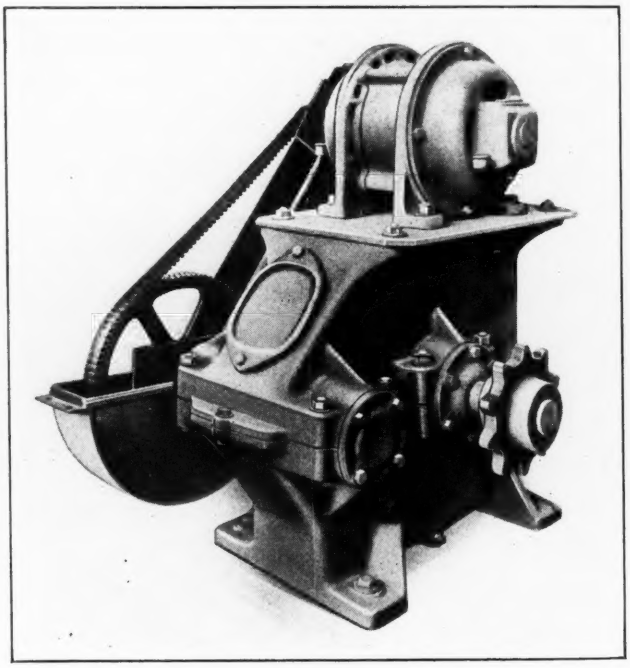
An oil-pump and piping are furnished when the machine is to handle material requiring a lubricant. A 16- or an 18-inch three-jaw geared scroll chuck or air chuck can be supplied. When the machine is to be motor-driven, the motor is mounted on a plate directly on the headstock and drives through a multiple V-belt.

Some of the important specifications of this machine are as follows: Size of platen, 50 1/2 by 45 inches; swing over top of platen, 17 3/4 inches; swing over gap in platen, 23 3/4 inches; travel of platen, 12 inches; maximum travel of standard tool-slides, 6 inches; special tool-slides can be furnished with a maximum travel of 10 inches; maximum length of work that can be held between centers, 18 1/2 inches; diameter of hole through spindle, 2 5/8 inches; and net weight of machine, about 10,800 pounds.

CALDWELL SPEED REDUCER

Two separate drives, a Link-Belt silent chain drive from the motor or high-speed shaft, and a cut spur gear drive to the low-speed shaft, are employed in a speed reducer recently brought out by the H. W. Caldwell & Son Co., a subsidiary of the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. The reducer is built in two styles, the illustration showing type A, which is intended for use in connection with conveyors, elevators, and various kinds of machinery. Type B is especially designed for driving screw conveyors, and is of the same design as type A with the exception that the housing is split vertically. Part of the housing forms the box end of the screw conveyor.

The reducer is built in various sizes, to provide ratios from 7 to 1 up to 40 to 1 in the case of type A, and up to 30 to 1 in the case of type B. Speed ratios may be changed at any time by substituting a different-sized motor pinion or silent chain wheel.

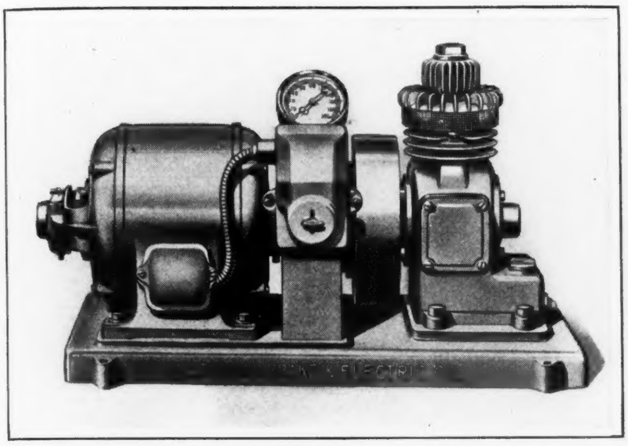


Caldwell Speed Reducer with Silent-chain and Spur-gear Drives

The silent chain eliminates the use of a flexible coupling on the motor shaft, as the chain provides flexibility between the motor and the first speed reducer shaft. Timken tapered roller bearings carried in cartridge mountings that are readily accessible are employed. Another feature of the reducer is that the gears and bearings are automatically lubricated from a large oil reservoir in the housing base. An adjustable motor bedplate facilitates adjusting the silent chain.

NATIONAL SLEEVE VALVE AIR COMPRESSORS

Air compressors of a vertical single-stage design, with a mechanically operated sleeve type of intake valve, are being introduced on the market by the National Brake & Electric Co., Division of the Westinghouse Air Brake Co., Milwaukee, Wis. One- and two-cylinder models of these SV compressors are built in various small sizes, with dis-



Air Compressor with Sleeve Type of Intake Valve

placements ranging from 2 to 16 cubic feet. They are suitable for pressures up to 150 pounds per square inch. There are both air-cooled and combination air- and hopper water-cooled types, and belt or direct-connected motor drives may be furnished. The illustration shows a motor-driven one-cylinder air-cooled model assembled on a base. This base, with the equipment assembled, can be mounted on an air tank and the necessary hose and piping supplied.

One of the features pointed out for the sleeve intake valve is that its movement is synchronized with the movement of the piston, irrespective of the piston speed. Due to the large diameter of the sleeve valve, it requires a lift of less than 1/64 inch. This feature, together with the design of the sleeve valve seat, which is flexible and acts as a cushion, assures quietness of operation. The valve seat consists of two thin flat phosphor-bronze disks or rings, which are mounted on the cylinder head.

The discharge valve chamber is completely isolated from the compression chamber or cylinder, this construction helping to keep the temperature of the discharged air down to a minimum. No gaskets are required between the cylinder head and the compressor body. In case there is breakage of piston-rings, or wear or scoring of the sleeve valve, replacement of these parts can be made in a short time, thus eliminating the necessity of "laying up" the compressor. It is mentioned that the replacement of a sleeve valve, piston, and rings in a single-cylinder air-cooled compressor, was accomplished in less than thirty minutes.

SOCIETE GENEVOISE MEASURING AND DRILLING MACHINE

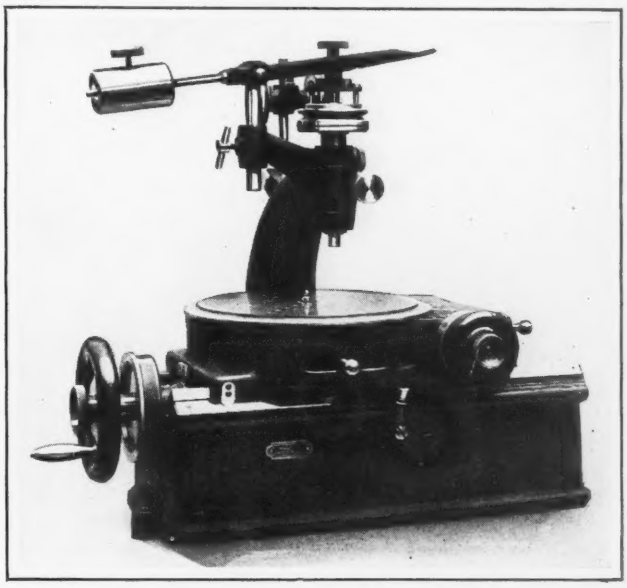
A combined precision measuring and sensitive drilling machine has been placed on the market by the Société Genevoise d'Instruments de Physique of Geneva, Switzerland, through its American agent, the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The machine is primarily intended for measuring in polar coordinates, the slide which moves on the bed of the machine having a circular table as an integral part of it, with which angular measurements may be made to 30 seconds of an arc. By means of a lead-screw which moves the table along its ways, measurements of length over a range of 4 inches may be made to 0.0002 inch. A microscope magnifying twenty-seven times is used for taking the readings. This microscope is mounted on the main arm of the machine. When the machine is used for drilling, a small headstock is mounted on the arm in place of the microscope.

The bed of the machine is provided with two ways, one flat and one V-shaped. The table is held under tension against the nut of the micrometer screw to eliminate backlash, by means of a wide steel tape which passes over a drum actuated by a coil spring. The pitch of the micrometer screw is 10 threads to the inch, and the large micrometer drum is graduated into 500 divisions. It may be set at zero for any desired position of the slide, and is provided with a large handwheel made of insulating material to prevent the heat of the user's hand from affecting the measuring elements. Provision is also made for correcting the readings for any small errors in the micrometer screw.

A worm of hardened steel with ground threads actuates the rotation of the circular table. It is fitted with a micrometer drum graduated into 240 divisions, giving direct readings to half minutes of arc. This micrometer drum can also be set at zero at the beginning of a series of settings. The circular table is made of hard bronze, and is 8 inches in diameter with graduations in degrees at its rim. Twenty-one tapped holes are provided in the surface of the table for attaching work. It is possible to make any measurements or accurately drill holes within a circle of 4 inches. A spring center is provided at the center of the circular table so that work having a central hole can quickly be centered.

The microscope can be focussed at any point up to 1 3/8 inches above the table. It is therefore possible to mount a photographic plate at sufficient height above the table so that the mirror set at a 45-degree angle below it may provide illumination from below. Glass plates for supporting small objects such as watch wheels and other small gears can also be illuminated from below.

In addition to the measuring facilities, a headstock is provided by means of which holes may be drilled with great accuracy. This headstock fits the same holder as the microscope. A sensitive lever balanced by a counterweight is used for depressing the drill or end-mill through its 1/2 inch



Combined Measuring and Sensitive Drilling Machine

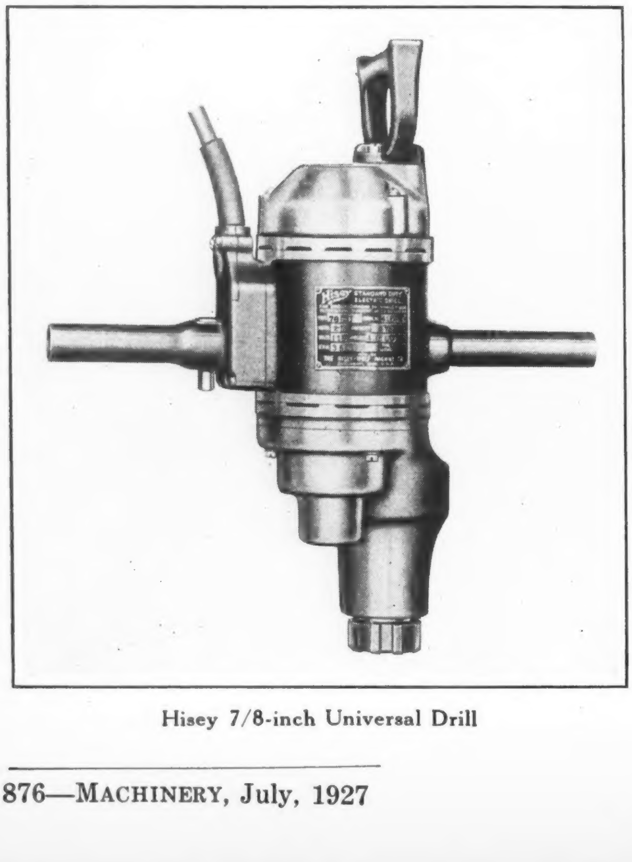
of feed travel. The spindle is driven by a 1/4-inch round belt. The table can be clamped to the bed of the machine by a lever during drilling operations. The spindle will take collet chucks up to a 1/4-inch body and will drill holes up to 0.175 inch in diameter.

This machine will be found useful in the toolroom or the inspection department for checking or making special gages or master plates, and for the laying out of cams and profiles. It will also be of value in the model shop, and in the experimental department where small parts such as are used in watches, clocks, meters, computing machines, sewing machines, and typewriters, are made. It will be found useful in the industrial testing and research laboratory, where a general utility measuring machine is required and where an occasional job of accurate drilling may be needed. The overall dimensions of the machine are 15 by 19 1/4 by 14 1/4 inches high, not including the microscope. The net weight is 140 pounds.

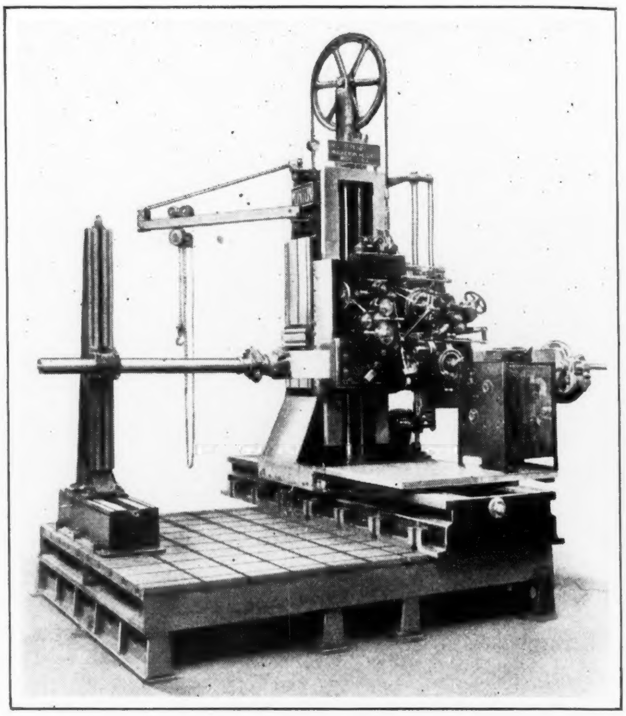
HISEY UNIVERSAL DRILL

A 7/8-inch capacity universal drill recently placed on the market by the Hisey-Wolf Machine Co., Cincinnati, Ohio, is shown in the accompanying illustration. This drill is equipped with a standard Hisey motor which is mounted in ball bearings. The ball bearings are fitted in a way that eliminates slip and creeping action. The gear on the armature shaft is removable, and the compound gear shaft is supported by a bearing at each end. The drill spindle has a No. 2 Morse taper socket. Automatic lubrication is provided to the spindle.

Brush-holders with adjustment for spring tension are mounted as a separate unit on a bakelite yoke. This feature permits brush adjustment when necessary. The end handle cover is independent of the motor and motor bearings, thus relieving those parts of all strain. This construction also affords convenient access to the carbon brushes for adjustment or renewal. The drill weighs 25 pounds.



Hisey 7/8-inch Universal Drill



Morton Draw-cut Planer Arranged for Boring and Milling

MORTON TRAVELING-HEAD PLANER

Planing, milling, boring, and drilling operations can be performed on the 60-inch stroke draw-cut traveling-head planer built by the Morton Mfg. Co., McKinney Ave. and Hoyt St., Muskegon Heights, Mich. Vertical milling and right-angle boring operations can be performed, as well as ordinary milling and boring operations. The machine can be furnished with any length of bed or height of column, and it can be arranged for shaping and planing only, by eliminating the boring, milling, and drilling features. The column has a horizontal travel of 9 feet on the bed, and the head has a vertical travel of 5 feet on the column.

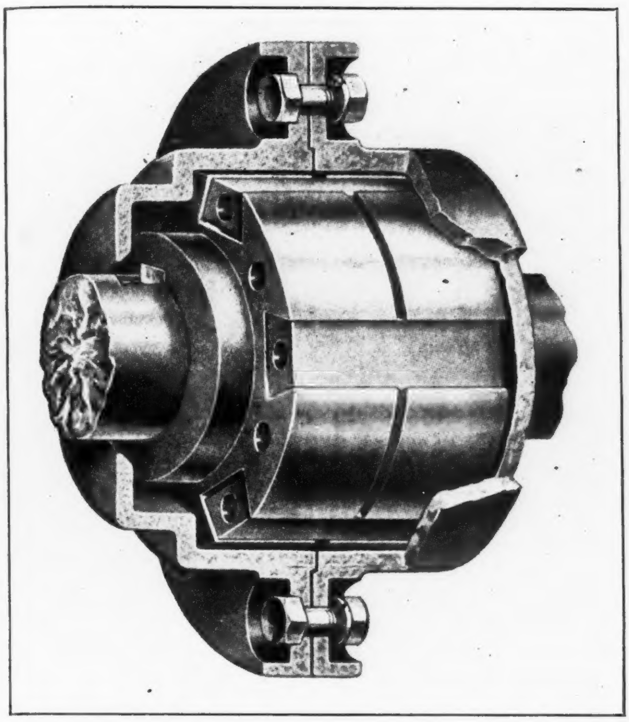
Milling and boring feeds are obtained automatically, and are rapidly changed, being controlled by one lever. The feed gear-box gives eight changes in each direction. Boring and milling are accomplished by means of a hollow steel arbor, which is passed through the ram and properly journaled. This arbor is bored to receive taper milling cutters, boring-bars, and other special equipment. In planing or shaping operations, the machine automatically feeds horizontally or vertically.

When using a reversing motor drive, power is transmitted through miter gearing and through a vertical shaft to the operating mechanism in the vertically moving apron. The planer can be used either as a stationary or a portable machine. It can be quickly changed for taking push cuts, thus being converted into a traveling-head slotter.

NICHOLSON FLEXIBLE COUPLING

Improved lubrication features are embodied in a flexible coupling recently added to the line manufactured by W. H. Nicholson & Co., 112 Oregon St., Wilkes-Barre, Pa. With the exception of the lubrication features, this coupling is of the same design as that described in December, 1926, MACHINERY.

From the accompanying illustration, it will be



Nicholson Flexible Coupling with Lubricating Feature

seen that in the new coupling, holes are drilled longitudinally through the floating keys and hubs. These holes act as reservoirs for oil. A lip is also extended from the casing over the left hub of the coupling to form a reservoir. Oil can be squirted into this reservoir by means of an oil-can, either with the coupling standing still or in motion.

With this reservoir and the space created by the holes, the coupling carries approximately 150 per cent more oil than the older type. All working parts are constantly flooded with oil, an oil film being maintained between the moving surfaces which decreases wear and affords a cushioning effect between the driving parts. This oil-lip type of coupling is known as style A, and the old type without the oil lip, as style B.

STARRETT NEW PRODUCTS

Two new products—a No. 324 flexible steel rule and a No. 588 combination reference table and rule—have been added to the line of tools manufactured by the L. S. Starrett Co., Athol, Mass. The flexible steel rule is graduated for a length of 6 inches, and is designed especially for use in close work. It is graduated in sixty-fourths of an inch on one side and in thirty-seconds of an inch on the other. The graduations are on opposite edges and read from one end.

One side of the combination reference table and rule has decimal equivalents, fractions of an inch, and a 6-inch rule with thirty-seconds of an inch divisions. The other side has tap and drill data and a 6-inch rule with sixty-fourths of an inch divisions. The graduations on the two sides are on opposite edges and read from the same end.

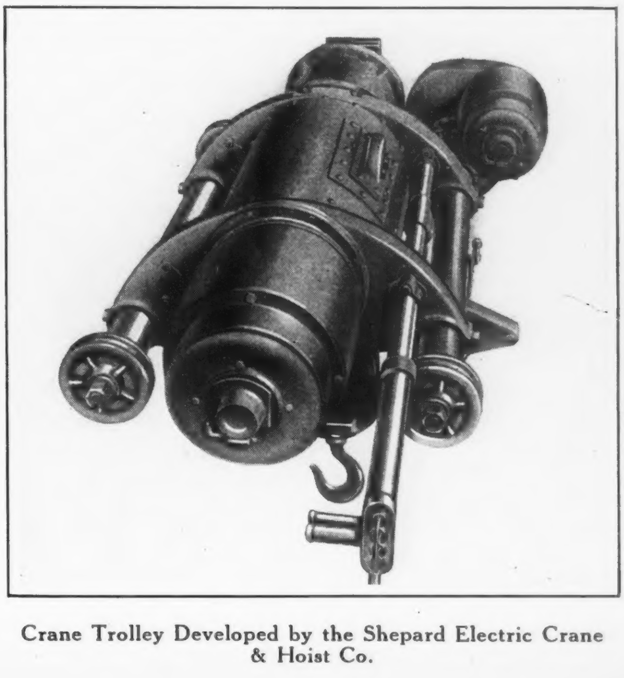
GOODELL-PRATT POLISHING AND BUFFING HEADS

Two small high-speed motor-driven polishing and buffing heads have been added to the line of electric tools manufactured by the Goodell-Pratt Co., Greenfield, Mass. They are intended for a large variety of light polishing, grinding, buffing, and drilling operations. The spindles of these heads are 3 5/8 and 4 1/4 inches, respectively, above the base. They are provided with a taper thread on one end, and an interchangeable arbor and three-jaw chuck of 5/32 inch capacity on the other end. Polished aluminum stands and housings are furnished. A grinding wheel and cloth buffing wheel, both with a 1/2-inch face, are supplied as regular equipment. The motors are of the universal type for use on any circuit of 110 volts. The No. 1060 head develops about 1/30 horsepower, while the No. 1061 head develops approximately 1/10 horsepower.

SHEPARD CRANE TROLLEY

A new crane trolley has been developed by the Shepard Electric Crane & Hoist Co., 382 Schuyler Ave., Montour Falls, N. Y. The new trolley includes the features incorporated in previous types of Shepard electric hoists and cranes—a balanced drive, straight-line construction in units each separately accessible, and automatic oil-bath lubrication. The sectionalized construction permits each trolley to be built up of units most suitable for the service intended. The entire range of crane trolley construction covers seven distinct types.

In developing this new design, clearances have been made as small as possible, and a special low head-room type is included for use where overhead clearances are limited. The load-carrying frame is of all steel construction. The frame is carried by axle brackets of heavy seamless drawn steel tubes, passing through bored openings in the load-carrying frame, so that the entire load-carrying structure from trolley wheels to winding drum is of steel. The drums are cast on end, of semi-steel, insuring freedom from defects. The hoist motor, as well as the trolley motor, may be mounted by two different methods, according to the requirements. Any type of motor—solid or split frame—may be used.

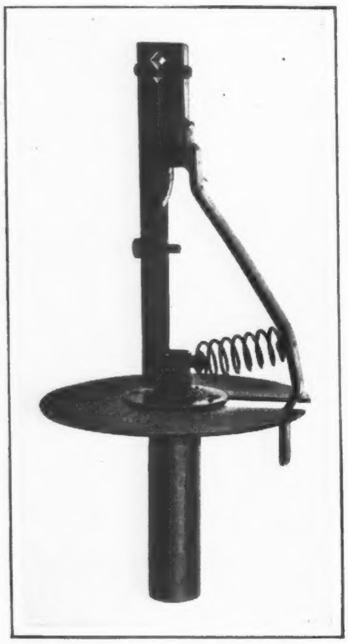


Crane Trolley Developed by the Shepard Electric Crane & Hoist Co.

The trolley axle bearings are waste-packed and supplied with oil cellars communicating with the pool retained within the axle bracket tubes. Oil for all four bearings is supplied through a single pipe connecting both axle bracket tubes. The trolley wheel at one end of the axle is pressed or shrunk on, the wheel at the opposite end is mounted on a taper by a nut, making the wheel secure, yet easily removable. The trolley gearing has been increased in size, with larger gears and higher gear ratios than formerly. The load block is fully enclosed, preventing the workman from getting his hands caught between the rope and the sheave.

LINCOLN HEAVY-CURRENT ELECTRODE-HOLDER

Metal electrodes up to 1/2 inch in diameter can be held in a type TR 600-ampere holder just brought out by the Lincoln Electric Co., Cleveland, Ohio. Among the various improvements claimed for this holder are replaceable copper jaws, a four-line contact for the electrode, an all-copper path for the welding current, a structural steel construction which gives maximum strength, light weight with a good balance, a cool insulated and ventilated handle, and a shield for protecting the operator's hand. This holder has been developed to meet the needs of heavy-current welding, and is said to permit the operator to obtain the desired results with the maximum degree of comfort.

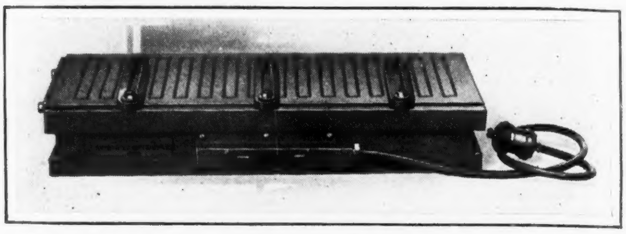


Lincoln Metal Electrode-holder

TAFT-PEIRCE MAGNETIC CHUCKS

Magnetic chucks for which an unusually high degree of holding power is claimed are being placed on the market by the Taft-Peirce Mfg. Co., Woonsocket, R. I., under the trade name of "Superpower." Various sizes and styles are manufactured. They are intended for operation with direct current only, of either 110 to 125 or 220 to 250 volts. Several patent claims have been issued on the construction of these chucks.

Each chuck comprises a base portion or body, integral with which are a number of projecting cores that are enclosed by a wall. Each core is magnetically energized by a coil of wire which is connected with similar coils in such a manner as to be electrically energized by direct current conducted to the interior of the chuck through a flexible cord extending from a terminal box. This terminal box is so secured to the chuck body that leads may be taken to it from either the left- or right-hand side of the chuck. Between the terminal box and the chuck body there is a water-tight gasket which prevents water or grinding fluid from reaching the interior of the chuck body.



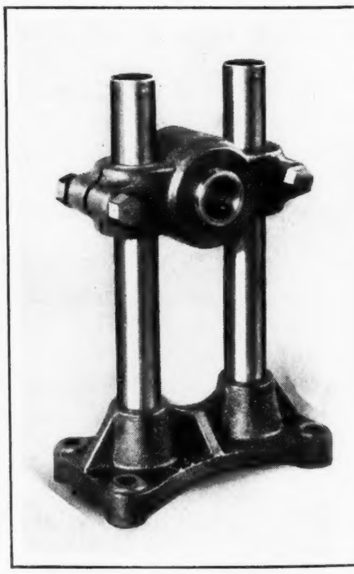
Taft-Peirce "Superpower" Magnetic Chuck

The faceplate or magnetic working surface fastened to the top of the chuck body comprises a magnetizable frame having a series of closely spaced bars of magnetizable material arranged transversely. Each bar has a surface which forms a pole face in the working face of the chuck. Mechanically united with this frame, but magnetically separated from it, is a series of bifurcated pole members. The frame of the faceplate registers with the walls of the chuck body, and the base of each bifurcated pole member registers with one of the cores. These cores, in turn, are energized by individual coils as described.

The principles of construction enable the chucks to be built lower, so that they occupy less space under the wheel. It is mentioned that small pieces of work can be held securely through a thin sheet of steel laid on top of the faceplate. By this method, work may be distributed as found convenient, without regard to the pole pieces or the polarity of the chuck cores. This feature is especially desirable in handling small parts of irregular contour. Another novel set-up which may be employed is that of holding work above the faceplate by means of parallels or angle-blocks. In such an instance, clamps are unnecessary, as the work is held by the leakage of magnetic flux through the steel parallels.

BOSTON GEAR WORKS OUTBOARD BEARINGS

An adjustable outboard bearing, as shown in the accompanying illustration, has been placed on the market by the Boston Gear Works Sales Co., Norfolk Downs, Quincy, Mass. These bearings are especially adapted for outboard supports of projecting shafts, countershaft hangers, temporary bearings requiring future adjustment, gear mountings where an oil-tight case is not necessary, and pillow blocks. As shown, the height of these bearings is adjustable. They are provided with bronze



Outboard Bearing Made by the Boston Gear Works

bearing bushings to insure an efficient bearing surface. These outboard bearings are made in a number of sizes with bores in the bronze bushing varying from 1/2 inch to 2 1/8 inches. The lengths of the bronze bushings vary from 1 1/4 to 4 inches.

* * *

DRILLING KEYWAYS IN ASSEMBLED PARTS

By ELTON STERRETT

The method of drilling out metal for keyways in assembled parts described on page 613 of April MACHINERY is doubtless all right in some cases, but trying to follow the same procedure brought the writer one of the worst "call downs" received during his apprenticeship. We were assembling a speed-box in which a pulley with a 4-inch wide hub was to be keyed to a short shaft having a gear with a 3-inch wide hub at the other end. The shaft was made of ordinary cold-rolled machine steel, the pulley of cast iron, and the gear of cast steel.

The shop was short of tools and quick delivery of the work was necessary. Under these conditions, the drilling method of blanking or roughing out the keyways was tried. Being the apprentice, I was given the drill press job of boring out the excess material in the manner described in the article referred to. Theoretically, the drill should have gone merrily on its way, removing stock equally from the shaft and pulley, but it failed to do this.

When drilling the assembled pulley and shaft, the drill dug into the shaft in nearly every case. The increased resistance of the harder cast iron caused the drill imperceptibly to work its way out into the more easily cut steel, so that at the end of the drilling operation all of the cut was being taken in the shaft. In the case of the gear and shaft assembly, the heat-treated gear steel cut more readily than the shafting, so that the drill had a tendency to run out into the gear hub.

After I received a "call down" for spoiling the work, the foreman undertook to show me how the work should be done—with equally unsatisfactory results. Consequently, it was necessary to continue the work of cutting the keyways with a hammer and chisel. That evening, after working hours, I obtained permission from the proprietor to do a little experimental work I turned down a 4-inch long block of cast iron, making it a press fit for the bore in one of the pulleys, and again tried out the drilling method of removing metal for the keyways. With cast iron on both sides of the drill, it was forced to cut evenly and showed no disposition to deviate from a straight path, half of the hole produced being in the pulley and half in the plug.

The improvised filler or plug was pressed out of the hub of the drilled pulley and inserted in the next pulley to be drilled. In this way each plug or filler served in boring twelve keyway grooves before its outer edge was cut away to such an extent that it would no longer fit the bore of a pulley hub. A similar cast-steel plug was used in drilling out keyway grooves in the gear hubs.

Soft steel collars for use in drilling the shaft half of the keyway were also tried out, but it was found cheaper and quicker to employ a night workman for cutting the shaft keyways on the overworked milling machine. This left only the quarter-round fillet in the pulley and the gear keyway grooves to be chipped out by hand. In view of my experience, I feel that the method suggested in April MACHINERY should be restricted to cases in which the assembled parts are of the same material.

By W. H. HIMES

The writer was pleased to see the "drilling out" method of producing keyways in assembled parts described in April MACHINERY, page 613. It was disappointing, however, to note that it was recommended that the corners of the keyway be squared by means of a hand chisel. Why spoil a good machining job with hand work? A good keyway is finished as soon as the hole is drilled. To key the parts together, simply use round cold-rolled steel of a size that is a good driving fit in the drilled hole.

The writer has keyed hundreds of pump cranks on their shafts by this method. For instance, if the shaft is of small diameter an "N" size drill can be used, in which case 5/16-inch cold-rolled steel can be used for a key, as it is a nice drive fit in the hole made with a properly ground drill of this size. It is best to chamfer the end of the pin slightly and put a drop of oil on it before driving it into place.

This method of keying is not only cheaper than the square key method, but it provides a better fit than is likely to be secured when hand work is introduced. Also the stress concentration inherent in the square keyway with its sharp corners is avoided when using the round key method.

* * *

EMBOSSED LUG OR DOWEL

By R. A. HEYDEN

In May MACHINERY, on page 683, the illustration Fig. 5 shows an embossed lug or dowel used to align assembled parts. The portion made by the embossing punch is shown to be of the same diameter as the portion made by the embossing die. This is bad practice, as it is a semi-perforating operation, in which the stock has already been broken through, so that the dowel is held in place by only a small frictional area.

A better manner of doing this job would be to have the embossing punch made approximately one and one-half times larger in diameter than the opening in the embossing die. This method has been tried with much success in one of the largest manufacturing companies in the Middle West.

* * *

LINCOLN ARC WELDING PRIZES

The Lincoln Arc Welding Prizes totalling $17,500 and consisting of a first prize of $10,000, a second prize of $5000, and a third prize of $2500, given by the Lincoln Electric Co. of Cleveland, Ohio, and administered by the American Society of Mechanical Engineers, have been previously referred to in detail in MACHINERY (see February number, page 480). Additional suggestions for the preparation of papers to be entered in the competition may now be obtained by addressing either the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio, or the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SUPPLY AND MACHINERY DISTRIBUTORS' MEETING

The twenty-second annual convention of the National Supply and Machinery Distributors' Association was held in conjunction with the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association on the Steamship *Noronic* on the Great Lakes, June 13 to 17. A complete program was provided and the discussions covered many problems of the supply and machinery distributor. Among the subjects discussed were: "How Can the Distribution of Mill Supplies be Made Profitable?"; "Business Conditions in Various Sections"; "How Can the Manufacturer Assist the Distributor?"; "How Can the Distributor Render Better Service to the Manufacturer?"; "Methods of Securing Increased Recognition of the Distributor by the Consumer"; "Are Distributors Simplifying Their Businesses Through the Elimination of Unprofitable Lines?"; "Are Manufacturers Taking Advantage of the Opportunity Offered Them by the Division of Simplified Practice of the Department of Commerce?"; "Is Emphasizing Price Rather than Service One of the Chief Causes for Lack of Net Profits?"

Outlook in the Machinery Distributing Field

B. H. Ackles, president of the association, stated in his annual address, that the developments of the last ten years, and particularly the present hand-to-mouth buying, has indicated to all that the distributor in the mill supply field is performing a most essential function on the most economical basis possible.

Many of the problems of the distributor have been made more acute by increased overhead and by unusually keen competition. New problems are constantly arising in the entire industrial field, but that of distribution is undoubtedly one of the most important. Different methods and alleged short cuts have been attempted in many industries. Mr. Ackles stated that he was convinced that such experiments are, in the vast majority of instances, costly and ineffective, and in the end will conclusively demonstrate the true value and effectiveness of the service rendered by distributors in obtaining wide distribution in a most efficient and economical manner. He emphasized, however, the necessity of keeping fully abreast of the times, and if the distributor is to succeed, he must adjust his business to the new conditions rather than rely upon the accomplishments of the past.

"Since our last convention," said Mr. Ackles, "general business conditions have remained sound and many industrial and financial leaders believe that we may look toward the future with confidence. For many months car loadings have indicated a tremendous distribution of merchandise. Freight carried by the railroads during the fall and early winter of 1926 shattered all previous records. After the usual seasonal decline at the end of the year, car loadings continue unusually heavy. Despite this tremendous movement of merchandise, stocks are reported light in most industries, and many interpret that fact as indicative of a steady and rapid consumption of merchandise, which insures sustained demand.

"Financial conditions are satisfactory. Our banks are supplied with funds sufficient to finance all legitimate enterprises without strain. Moreover, labor is well employed, and current wages, according to a recent estimate by the United States Department of Labor, average 133 per cent above the 1913 level. Steady employment at high wages has provided the people of this country with funds sufficient to supply their current requirements generously and to accumulate a reserve as protection against less favorable conditions. I believe, therefore, that we should approach our problems in a spirit of optimism."

Edward P. Welles, of Chicago, Ill., was elected president of the National Supply and Machinery Distributors' Association, with H. H. Kuhn, of Akron, Ohio, as vice-president. Robert B. Skinner, of New Britain, Conn., was elected president of the American Supply and Machinery Manufacturers' Association, with W. C. Henning, of St. Louis, Mo., C. O. Drayton, of Worcester, Mass., and Horace Armstrong, of Chicago, Ill., as vice-presidents. T. C. Keeling, of Nashville, Tenn., was elected president of the Southern Supply and Machinery Dealers' Association, with W. W. Doe of Montgomery, Ala., and D. D. Peden of Houston, Texas, as first and second vice-presidents. George A. Fernley of Philadelphia, Pa., is secretary-treasurer of the National Supply and Machinery Distributors' Association.

* * *

PRODUCTION MEETING OF AUTOMOTIVE ENGINEERS

The 1927 production meeting of the Society of Automotive Engineers will be held September 19 to 22 inclusive. The first two days, Monday and Tuesday, the meeting will be held at the Hotel Winton, Cleveland, Ohio, and the second two days, Wednesday and Thursday, it will be held at the Hotel Statler, Detroit, Mich. The reason for holding the meeting in two places on consecutive days is to make it possible for the Detroit members attending the production meeting to also attend the exposition of the National Machine Tool Builders' Association in Cleveland, and for the Cleveland members to attend the exposition of the American Society for Steel Treating in Detroit.

It is proposed that members leave Cleveland Tuesday night by the Detroit boat, so as to arrive in Detroit for the meeting Wednesday morning.

* * *

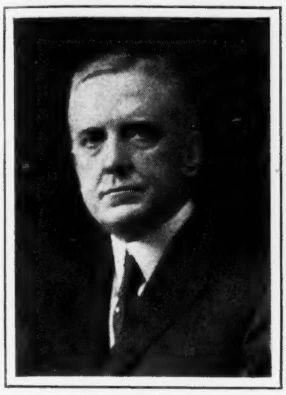
EXHIBIT OF THE SOCIETY FOR STEEL TREATING

The management of the National Steel and Machine Tool Exposition, to be held in Detroit during the week of September 19 under the auspices of the American Society for Steel Treating, announced on May 26 that space had been reserved up to that date for 262 exhibitors, over 80,000 square feet having been called for. The total available space for exhibit purposes is approximately 90,000 square feet, thirty-nine spaces remaining unreserved on May 26. Approximately 10,000 square feet will be devoted to an exhibit of welding material and equipment, and the American Welding Society will hold its annual fall meeting this year in Detroit during the week of the exposition.

OBITUARIES

GUY E. TRIPP

Brigadier General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Mfg. Co., died Tuesday, June 14, in the New York Hospital, New York City, from complications following an operation. General Tripp was born in Wells, Me., April 22, 1865. He was educated at the South Berwick (Maine) Academy, and at the age of eighteen he entered the employ of the Eastern Railway Co. as a clerk, remaining for seven years, during which time he was promoted to chief clerk of the maintenance of way department. In 1890 he became storekeeper for the Thompson-Houston Electric Co., which then had a contract for the electrification of the West End Railway of Boston. He was shortly made traveling auditor for the company, in which capacity he visited and reported on many public utilities.



Guy E. Tripp

In 1897 he became associated with Stone & Webster, construction engineers and operators of public utilities, occupying various important positions until he was elected vice-president of the Stone & Webster Management Association and also of the Stone & Webster Engineering Corporation. In 1910 when this company was called into consultation on the affairs of the Metropolitan Street Railway Co. of New York, which had passed into receivership, Mr. Tripp was appointed special representative and later was made chairman of the joint committee on reorganization. After he had completed this work, early in 1912, he was elected chairman of the board of directors of the Westinghouse Electric & Mfg. Co., in which capacity he continued until his death. Under his guidance this company took its place among the world's foremost industrial organizations.

Shortly after the United States entered the World War, Mr. Tripp was made chief of the production division of the Ordnance Department because of his intimate knowledge of manufacturing and his broad executive experience. He entered the service in January, 1918, as a Major in the Ordnance Department, and within ten months was made a Brigadier General and assistant to the Chief of Ordnance of the United States Army. Upon leaving the service after the Armistice, he was awarded the Distinguished Service Medal by the President of the United States.

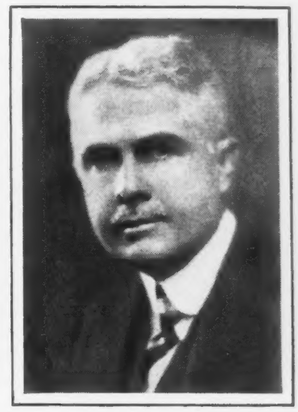
In the last few years Mr. Tripp manifested an especially keen interest in the future of the electrical development in America. His articles and addresses on power development have attracted wide attention and a compilation of the more important of these under the title "Superpower as an Aid to Progress" is regarded as an authoritative contribution to this subject. He was a director in more than a score of companies and a member of as many societies and organizations in the commercial and engineering field.

P. William Kromer, Buffalo district manager of the Air Reduction Sales Co., New York City, died at the Buffalo General Hospital, May 21, aged forty-seven years, following an illness of five weeks. Mr. Kromer had been identified with the oxy-acetylene industry for nearly twenty years. He was connected with the Air Reduction Sales Co. for eleven years, and previous to that was the local manager of the Niagara Oxygen Co. He had also been connected with the Searchlight Co. and other producers of gases, and had been manager of a job welding shop in Binghamton, N. Y.

EDWIN S. JACKMAN

Edwin S. Jackman, head of the firm of E. S. Jackman & Co., with headquarters at Chicago, Ill., representing the Firth-Sterling Steel Co., died May 30 at Santa Barbara, Calif. Mr. Jackman was born in East Liverpool, Ohio, April 11, 1865. He attended the public schools at Allegheny City, Pa., and for a short time was a student at the Western University, now the University of Pittsburg. His first work was in a telegraph office, and in 1882 he became employed by Park, Bro. & Co., Ltd., where his ability was quickly recognized and he was started in sales work. He was transferred from Pittsburg to New England, and then to Philadelphia, and later to the West.

In 1887 Mr. Jackman became western manager for Howe, Brown & Co. After establishing their business in the west, he returned to the Park organization as manager of the western business, remaining until the organization of the Crucible Steel Co. of America in 1900. At that time he became the agent for the Firth-Sterling Steel Co., operating as E. S. Jackman & Co., with headquarters in Chicago, where, starting in a very small way, he built a business and organization which spread from Pittsburg to the Pacific Coast.



Edwin S. Jackman

Mr. Jackman was an idealist in business, with a remarkable ability as a writer. At a time when the business world was most interested in efficient methods and machines, he published "Firth-Sterlingism," featuring the human element in business. When it was popular to malign the railroads, he courageously published his widely quoted "Tribute to the American Railroads and the Men who Run Them." Before there was a Federal Trade Commission, he took a firm stand against unfair competition in business and tried vigorously to wipe out all those practices in sales work which had made selling synonymous with drinking, extravagant entertaining, and other demoralizing practices. His whole business career was an effort to interpret in practical form certain high ideals in character development, while building a sound, profitable business. In this he was well ahead of his time.

PERSONALS

T. H. Schebrat has recently become associated with the Cincinnati Shaper Co., Cincinnati, Ohio, as sales engineer.

T. P. Gaylord, acting vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been elected president of the Pittsburg Chamber of Commerce.

E. E. Caswell, who has represented the Union Twist Drill Co., Athol, Mass., through central New York state for several years, has been appointed manager of the Chicago store, 11 S. Clinton St., Chicago.

Charles L. Cameron, formerly sales manager of Gould & Eberhardt, Newark, N. J., is now factory representative in the northern New Jersey territory for the Monarch Machine Tool Co., Sidney, Ohio.

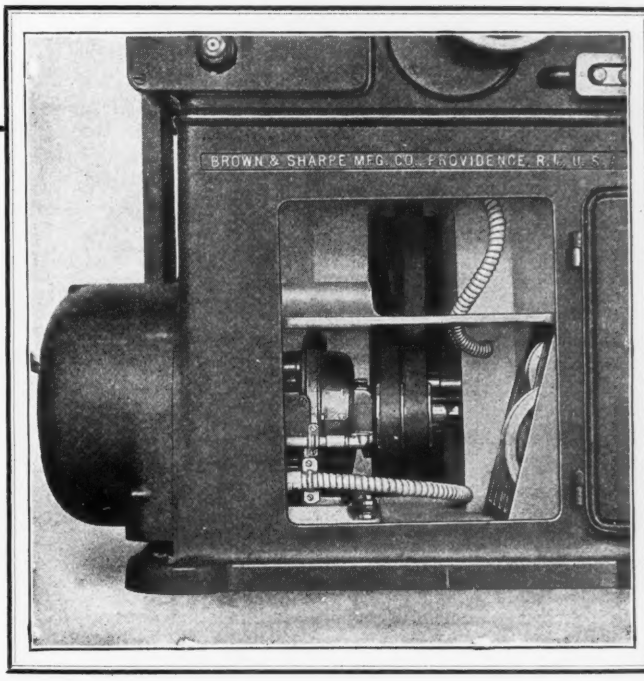
W. H. Kissam has been appointed New York district manager of the steel department of Henry Disston & Sons, Inc., Philadelphia, Pa. Mr. Kissam was formerly sales manager of the Cyclops Steel Co.

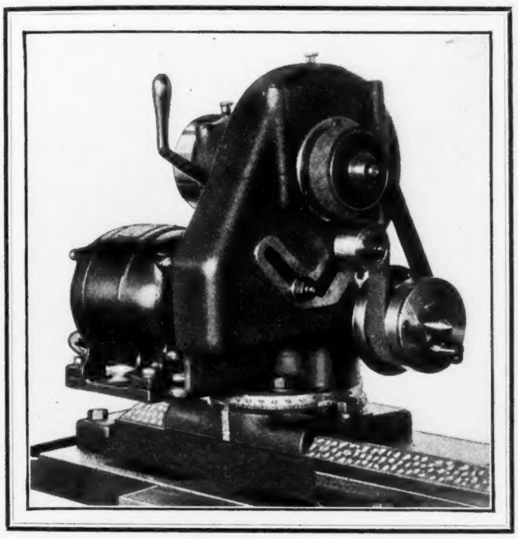
O. Lundell, president and general manager of the Michigan Tool Co., Detroit, Mich., sailed for a three months' visit to Europe on the SS. *Gripsholm*, June 11. Mr. Lundell expects to spend the larger part of his time in Sweden.

A. H. Moore, who has been associated with the General Electric Co., Schenectady, N. Y., for thirty-nine years, will retire as chairman of the standardizing committee August 1 on account of ill health. S. H. Blake will succeed Mr. Moore.

William L. Schoonmaker has been appointed sales manager of the Kent Co., Inc., Rome, N. Y. Mr. Schoonmaker formerly had charge of the export sales of motor-driven household appliances of the International General Electric Co.

William G. Wall, consulting engineer, Indianapolis, Ind., and now first vice-president of the Society of Automotive Engineers, was nominated for president to serve for the year 1928 at the semi-annual meeting of the society held at French Lick, Ind.





The motor compartment in the base is large and well ventilated and insures complete protection for the motor. Ample space permits of the installation of a generator to furnish direct current when a magnetic chuck is used. The generator is driven direct from the main motor. There is also ample storage room in the compartment for the change pulleys and other accessories.

The headstock is a compact, detachable unit, built sturdily and with sufficient weight to eliminate vibration. The speed changes are made with change pulleys and the work can be held by either live or dead centers. A convenient lever operates a quick acting clutch which starts and stops the rotation of the work without stopping the driving motor.

We shall be glad to send specifications of the machine or to have our representative tell you about it.

Brown & Sharpe Products

Milling Machines
Grinding Machines
Gear Cutting Machines
Screw Machines
Cutters and Hobs
Machinist's Tools
Gears Cut to Order

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

CHESTER W. RICE, who has been engaged in development work in the research laboratory of the General Electric Co., Schenectady, N. Y., has been made assistant to E. W. Allen, vice-president in charge of engineering. Mr. Rice will give special attention to new developments.

HARRY A. WHITE, previously associated with the Yale & Towne Mfg. Co., Stamford, Conn., has recently joined the sales staff of the Reading Chain & Block Corporation, Reading, Pa., and will be located at Philadelphia in charge of jobbers in the eastern part of the United States.

E. L. PARSONS, formerly district manager for the Ramsey Chain Co. of Boston, Mass., has recently joined the sales force of the Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., and has been appointed district representative for the state of Wisconsin and northern Illinois, with headquarters at 49 E. Wells St., Milwaukee, Wis.

R. N. ROBERTSON has been appointed chief engineer of the Andrews-Bradshaw Co., Pittsburg, Pa. A. L. MENZIN has been appointed director of research of the company. Mr. Robertson has been connected for the last twenty years with the American Smelting & Refining Co. Mr. Menzin was previously chief engineer of the Tracy Engineering Co.

WALTER E. THAU, manager of marine engineering, general engineering department, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been appointed director of marine engineering. Mr. Thau entered the employ of the Westinghouse organization in 1911 as an apprentice, and from that time on has steadily advanced to his present position.

R. P. SHIMMIN has been appointed assistant to the chairman and the president of the Link-Belt Co., and will make his headquarters at the executive offices of the company at 910 S. Michigan Ave., Chicago, Ill. FRANK B. CALDWELL has been appointed sales manager of the company, with headquarters at the Chicago plant office, 300 W. Pershing Road, and will have supervision over all sales activities in the western division.

Miss MARY DUNHAM, for the last ten years treasurer of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has been elected chairman of District B of the Federation of Zonta Clubs, Inc., which includes New York City, Washington, D. C., Montour Falls, Elmira, Ithaca, Hornell, and Watkins, N. Y. The Federation of Zonta Clubs has a membership of women in responsible executive positions, comparable with the Rotary and similar business clubs for men. Membership is confined to women engaged as proprietors, partners, corporate officers, or managers of important businesses.

E. M. HEWLETT has been appointed consulting engineer of the switchboard department of the General Electric Co., Schenectady, N. Y. Mr. Hewlett has been engineer of the switchboard department since its formation, and will be succeeded in that capacity by E. B. MERRIAM. The number of assistant engineers has been increased to three by the appointment of CHESTER LICHTENBERG, with headquarters at Philadelphia. Other changes in the switchboard engineering organization include the appointments of W. K. RANKIN as assistant designing engineer with headquarters at Schenectady, and G. E. STEWART, assistant designing engineer with headquarters at West Philadelphia.

W. S. MOODY, in general charge of the transformer engineering department of the General Electric Co., Schenectady, N. Y., since its inception, has been appointed consulting engineer for all transformer departments of the company and for all departments of the Pittsfield Works. F. W. PEEK, JR., who has been a consulting engineer in the transformer department and in charge of the high voltage testing laboratory, has been made engineer of the general transformer department to succeed Mr. Moody. Mr. Moody will continue to make his headquarters in Pittsfield, and as chairman of the steel standardizing committee will have general direction of all development work on magnetic steel for the company.

* * *

An equipment engineer in an automobile plant recently stated that, in his opinion, the flat belt drive for the main spindle of grinding machines could advantageously be replaced by the V-type rubber belt drive, as the latter type of drive produces a much steadier motion of the spindle and eliminates chatter to a great extent.

TRADE NOTES

AVEY DRILLING MACHINE CO., INC., Cincinnati, Ohio, has appointed George M. Galt, eastern sales representative for the company. He will act as direct factory representative, working in cooperation with Henry Prentiss & Co.

WILLIAM GANSCHOW CO., 16 N. Morgan St., Chicago, Ill., announces the appointment of the Schroer Bros., 2303-2305 Holmes St., Kansas City, Mo., as exclusive representative for the company in the states of Kansas and Oklahoma.

FALK CORPORATION, Milwaukee, Wis., manufacturer of herringbone gears, speed reducers, steel castings, Diesel engines, and flexible couplings, has opened an office in Chicago at 122 S. Michigan Ave. C. H. Thomas will be in charge of the new office.

WHITING CORPORATION, Harvey, Ill., has appointed J. F. Shouse & Co., 1197 Starks Bldg., Louisville, Ky., as sales representatives for the complete Whiting line of cranes, foundry equipment, and railway specialties in the state of Kentucky and the southern part of Indiana.

BIG THREE WELDING & EQUIPMENT CO., of Fort Worth and Houston, Tex., who are the Texas and Oklahoma distributors for "Stable-Arc" welders manufactured by the Lincoln Electric Co., Cleveland, Ohio, announces the opening of a third warehouse branch at 1 N. Frankfort St., Tulsa, Okla.

SIMONDS SAW & STEEL CO., Fitchburg, Mass., announces that Samuel Harris & Co., 114 N. Clinton St., Chicago, Ill., has been appointed distributor for the company in the Chicago district. A supply of files, hacksaw blades, tool-holder bits, and metal cutting band saws will be carried in stock.

BONNEY FORGE & TOOL WORKS, Allentown, Pa., have recently placed on the market an additional set of tools, neatly packed in a substantial black enameled carrying case with leather handle. This set consists of ten chrome-vanadium hexagon sockets, from 7/16 to 7/8 inch, inclusive, with ratchet, sliding T, brace, extension, and extension and universal joint.

GEUDER, PAESCHKE & FREY CO., St. Paul Ave. and 15th St., Milwaukee, Wis., has appointed H. L. Wilson, 514 National City Bank Building, Cleveland, Ohio, sales representative of the company for the Cleveland district. Arthur Dixon and Earl M. Hunker, Merchants Bank Building, Indianapolis, Ind., have been appointed sales representatives in the state of Indiana and the city of Louisville, Ky.

ROCKWOOD MFG. CO., Indianapolis, Ind., manufacturer of Rockwood paper pulleys and fiber frictions, held a sales convention May 29 to 31, at which forty-seven representatives of the Rockwood Paper Pulley Stores, Inc., were the guests of the company. This year marks the seventy-sixth anniversary in the history of the Rockwood concern. For over forty years the company has concentrated its production on Rockwood paper pulleys.

BROWN INSTRUMENT CO., 4418 Wayne Ave., Philadelphia, Pa., manufacturer of pyrometers, thermometers, flow meters, and indicating and recording instruments, announces the opening of a mid-western repair and service station at 217 E. Illinois St., Chicago, Ill. This service station is also in a position to furnish, from stock, charts, thermo-couples, protecting tubes, extension leads, instrument parts, and instruments of standard ranges.

GENERAL MFG. CO., 6436 Farnsworth Ave., Detroit, Mich., maker of flexible power presses for straightening, bending, and assembling operations, has appointed the Triplex Machine Tool Co., 50 Church St., New York City, its representative in New England, New York, New Jersey, and eastern Pennsylvania. The Richey-Whaley Machinery Co., 23 E. South St., Indianapolis, Ind., has been appointed representative in the Indianapolis machine tool territory.

ROTOR AIR TOOL CO., 5905 Carnegie Ave., Cleveland, Ohio, has purchased the pneumatic tool division of the Warner & Swasey Co. The new company will continue the manufacture and sale of the portable air tools developed by the Warner & Swasey Co. The present line of air grinders and drills will be expanded to include a complete line of portable air tools. The first addition to the line is a rotor air sander for metal finishing operations, such as grinding, sanding, or wire brushing. A direct selling organization has been established in the leading industrial centers.